

1995

Use and integration of computer-related technology in teaching by preservice teacher education faculty

Denise Ann Schmidt
Iowa State University

Follow this and additional works at: <https://lib.dr.iastate.edu/rtd>



Part of the [Communication Technology and New Media Commons](#), [Instructional Media Design Commons](#), and the [Teacher Education and Professional Development Commons](#)

Recommended Citation

Schmidt, Denise Ann, "Use and integration of computer-related technology in teaching by preservice teacher education faculty " (1995). *Retrospective Theses and Dissertations*. 11081.
<https://lib.dr.iastate.edu/rtd/11081>

This Dissertation is brought to you for free and open access by the Iowa State University Capstones, Theses and Dissertations at Iowa State University Digital Repository. It has been accepted for inclusion in Retrospective Theses and Dissertations by an authorized administrator of Iowa State University Digital Repository. For more information, please contact digirep@iastate.edu.

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

**A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
313/761-4700 800/521-0600**

**Use and integration of computer-related technology in teaching
by preservice teacher education faculty**

by

Denise Ann Schmidt

**A Dissertation Submitted to the
Graduate Faculty in Partial Fulfillment of the
Requirements for the Degree of
DOCTOR OF PHILOSOPHY**

**Department: Curriculum and Instruction
Major: Education (Curriculum and Instructional Technology)**

Approved:

Signature was redacted for privacy.

In Charge of Major Work

Signature was redacted for privacy.

For the Major Department

Signature was redacted for privacy.

For the Graduate College

**Iowa State University
Ames, Iowa**

1995

UMI Number: 9610982

UMI Microform 9610982

Copyright 1996, by UMI Company. All rights reserved.

**This microform edition is protected against unauthorized
copying under Title 17, United States Code.**

UMI

**300 North Zeeb Road
Ann Arbor, MI 48103**

TABLE OF CONTENTS

	Page
GENERAL INTRODUCTION	1
Dissertation Organization	2
TECHNOLOGY IN PRESERVICE TEACHER EDUCATION: NEED, CURRENT PROGRAMS, AND FUTURE OPPORTUNITIES	4
Rationale for Focusing on Preservice Teacher Education	5
Computer-Related Technology Use and Integration in K-12 Schools	7
Current State of Computer-Related Technology Use and Integration in Preservice Teacher Education Programs	17
Conclusions and Recommendations	31
IMPLEMENTATION AND ASSESSMENT OF A COMPUTER-RELATED TECHNOLOGY INTEGRATION MODEL FOR PRESERVICE TEACHER EDUCATION FACULTY	35
Introduction	36
Evolution of Technology Use and Integration by Preservice Teacher Education Faculty and Students	40
Method	49
Results	56
Conclusions and Implications	77
Appendix: Dependent T-Test Tables 8-32	82
STUDY OF THE USE AND INTEGRATION OF COMPUTER-RELATED TECHNOLOGY BY TEACHER EDUCATION FACULTY	91
Current State of Computer-Related Technology Use and Integration in Preservice Teacher Education Programs	92
Methodology	99
Results	112
Summary of the Results	132
Conclusions and Recommendations	135
Appendix: Dependent T-Test Tables 7-30	141

CONCLUSION	Page 149
REFERENCES	152
ACKNOWLEDGMENTS	159
APPENDIX A: COVER LETTER AND SAMPLE QUESTIONNAIRE	161
APPENDIX B: REMINDER POSTCARD AND FOLLOW-UP LETTER	170
APPENDIX C: SURVEY ITEMS INCLUDED IN EACH ATTITUDE FACTOR	176
APPENDIX D: IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 1, SECTION V	177
APPENDIX E: IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 4, SECTION V	179
APPENDIX F: IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 5, SECTION V	183
APPENDIX G: IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 6, SECTION V	186
APPENDIX H: IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 7, SECTION V	190
APPENDIX I: PEER UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 1, SECTION V	192
APPENDIX J: PEER UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 4, SECTION V	197
APPENDIX K: PEER UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 5, SECTION V	203
APPENDIX L: PEER UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM 6, SECTION V	209
APPENDIX M: PEER UNIVERSITY FACULTY WRITTEN RESPONSES TO SURVEY ITEM , SECTION V	216

APPENDIX N: DOCUMENTATION OF HUMAN SUBJECTS APPROVAL	Page 221
---	-------------

LIST OF FIGURES

	Page
IMPLEMENTATION AND ASSESSMENT OF A COMPUTER-RELATED TECHNOLOGY INTEGRATION MODEL FOR PRESERVICE TEACHER EDUCATION FACULTY	
Figure 1. Mean responses of Iowa State respondents for proficiency in using instructional technology equipment	58
Figure 2. Mean responses of Iowa State respondents for proficiency in using computer-related technology applications	61
Figure 3. Iowa State respondents' rating of their overall personal proficiency, their peers' proficiency, and their students' proficiency in using computer-related technologies	64
 USE AND INTEGRATION OF COMPUTER-RELATED TECHNOLOGY BY PRESERVICE TEACHER EDUCATION FACULTY IN SELECTED RESEARCH I UNIVERSITIES	
Figure 1. Respondents' years of teaching experience in higher education	110
Figure 2. Academic rank of respondents from seven Research I universities	111
Figure 3. Mean responses of respondents from seven Research I universities for proficiency in using instructional technology equipment	114
Figure 4. Mean responses of respondents from seven Research I universities for proficiency in using computer-related technology applications	116
Figure 5. Respondents' ratings of their overall personal proficiency, their departmental peers overall personal proficiency, and their students' overall personal proficiency in using computer-related technology	119

LIST OF TABLES

	Page
TECHNOLOGY IN PRESERVICE TEACHER EDUCATION: NEED, CURRENT PROGRAMS, AND FUTURE OPPORTUNITIES	
Table 1. Curriculum guidelines for accreditation of educational computing and technology programs developed by the Accreditation Committee of the International Society of Technology in Education	19
IMPLEMENTATION AND ASSESSMENT OF A COMPUTER-RELATED TECHNOLOGY INTEGRATION MODEL FOR PRESERVICE TEACHER EDUCATION FACULTY	
Table 1. Three levels of technology use in teacher education	39
Table 2. List of required courses for the educational computing minor offered by the Department of Curriculum and Instruction in the College of Education	44
Table 3. Iowa State faculty responses indicating what one factor helped them learn how to integrate computer-related technology into their courses	67
Table 4. Iowa State faculty responses indicating the reasons for using computer-related technology in courses	69
Table 5. Iowa State faculty responses indicating the barriers they encountered in using computer-related technologies	72
Table 6. Iowa State faculty responses indicating what support was available for them to integrate computer-related technology in teaching	73
Table 7. Iowa State faculty responses indicating what type of additional support would be most useful to them	75
Table 8. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a computer	82

	Page
Table 9. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a camcorder	82
Table 10. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using video editing equipment	10
Table 11. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a still video camera	83
Table 12. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a CD ROM	83
Table 13. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a modem	83
Table 14. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a distance education system	84
Table 15. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a scanner	84
Table 16. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for a laser disc player	84
Table 17. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a LCD panel	85
Table 18. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using word processing	85

	Page
Table 19. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using desk top publishing	85
Table 20. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a database	86
Table 21. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a spreadsheet	86
Table 22. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a grading program	86
Table 23. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a statistics program	87
Table 24. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a drawing program	87
Table 25. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using programming	87
Table 26. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a simulation	88
Table 27. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using problem solving software	88
Table 28. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using instructional software	88

	Page
Table 29. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using presentation software	89
Table 30. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a hypermedia program	89
Table 31. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using LAN communication	89
Table 32. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using the Internet/Bitnet	90

USE AND INTEGRATION OF COMPUTER-RELATED TECHNOLOGY BY PRESERVICE TEACHER EDUCATION FACULTY AT SELECTED RESEARCH I UNIVERSITIES

Table 1. Factor loadings for items in each attitude construct	105
Table 2. Faculty responses from seven Research I universities indicating what one factor helped them learn how to integrate computer-related technology into their courses	123
Table 3. Faculty responses from seven Research I universities indicating the reasons for using computer-related technology in courses	125
Table 4. Faculty responses from seven Research I universities indicating the barriers they encountered in using computer-related technologies	127
Table 5. Faculty responses from seven Research I universities indicating what support was available for them to integrate computer-related technology in teaching	129

	Page
Table 6. Faculty responses from seven Research I universities indicating what type of additional support would be most useful to them	131
Table 7. Descriptive statistics and t-test results for the current and past proficiency for using a computer by teacher education faculty from Research I universities	141
Table 8. Descriptive statistics and t-test results for the current and past proficiency for using a camcorder by teacher education faculty from Research I universities	141
Table 9. Descriptive statistics and t-test results for the current and past proficiency for using video editing equipment by teacher education faculty from Research I universities	141
Table 10. Descriptive statistics and t-test results for the current and past proficiency for using a still video camera by teacher education faculty from Research I universities	142
Table 11. Descriptive statistics and t-test results for the current and past proficiency for using a CD ROM by teacher education faculty from Research I universities	142
Table 12. Descriptive statistics and t-test results for the current and past proficiency for using a modem by teacher education faculty from Research I universities	142
Table 13. Descriptive statistics and t-test results for the current and past proficiency for using a scanner by teacher education faculty from Research I universities	143
Table 14. Descriptive statistics and t-test results for the current and past proficiency for using a laser disc player by teacher education faculty from Research I universities	143
Table 15. Descriptive statistics and t-test results for the current and past proficiency for using a LCD panel by teacher education faculty from Research I universities	143

	Page
Table 16. Descriptive statistics and t-test results for the current and past proficiency for using word processing by teacher education faculty from Research I universities	144
Table 17. Descriptive statistics and t-test results for the current and past proficiency for using desk top publishing by teacher education faculty from Research I universities	144
Table 18. Descriptive statistics and t-test results for the current and past proficiency for using a database by teacher education faculty from Research I universities	144
Table 19. Descriptive statistics and t-test results for the current and past proficiency for using a spreadsheet by teacher education faculty from Research I universities	145
Table 20. Descriptive statistics and t-test results for the current and past proficiency for using a grading program by teacher education faculty from Research I universities	145
Table 21. Descriptive statistics and t-test results for the current and past proficiency for using a statistics program by teacher education faculty from Research I universities	145
Table 22. Descriptive statistics and t-test results for the current and past proficiency for using a drawing program by teacher education faculty from Research I universities	146
Table 23. Descriptive statistics and t-test results for the current and past proficiency for using programming by teacher education faculty from Research I universities	146
Table 24. Descriptive statistics and t-test results for the current and past proficiency for using a simulation by teacher education faculty from Research I universities	146
Table 25. Descriptive statistics and t-test results for the current and past proficiency for using problem solving software by teacher education faculty from Research I universities	147

	Page
Table 26. Descriptive statistics and t-test results for the current and past proficiency for using instructional software by teacher education faculty from Research I universities	147
Table 27. Descriptive statistics and t-test results for the current and past proficiency for using presentation software by teacher education faculty from Research I universities	147
Table 28. Descriptive statistics and t-test results for the current and past proficiency for using a hypermedia program by teacher education faculty from Research I universities	148
Table 29. Descriptive statistics and t-test results for the current and past proficiency for using LAN communication by teacher education faculty from Research I universities	148
Table 30. Descriptive statistics and t-test results for the current and past proficiency for using the Internet/Bitnet by teacher education faculty from Research I universities	148

GENERAL INTRODUCTION

Teacher education institutions are currently faced with the challenge of providing assistance and support for preservice teacher education faculty who are interested in using and integrating computer-related technology into teaching and learning (Beaver, 1990; Kortecamp & Croninger, 1995; Smith, 1994). Although several research studies have been designed to describe how K-12 school districts and teachers have addressed specific computer-related technology issues in education (Becker, 1985, 1986, 1990; Kirby, Wilson & Smith-Gratto, 1988; Office of Technology Assessment, 1995; Sheingold and Hadley, 1990), little has been done to assess how preservice teacher education faculty use and integrate computer-related technology throughout a teacher preparation program (Schrum, 1994). Because of the need to establish successful technology integration models that support teacher education faculty in their efforts to use and integrate computer-related technology, it is important to assess the current state of faculty development in these areas.

Several sources have suggested that colleges and universities must take a leadership role in preparing preservice teachers to use computer-related technology (Brooks & Kopp, 1989; Espinoza & McKinzie, 1994; Office of Technology Assessment, 1995). However, before technology use and integration throughout preparation programs can be realized, teacher education faculty must receive substantial amounts of training and support in using these technologies. Although some teacher education programs have identified the need to integrate and model the effective use of computer-related technology during courses, it is

difficult to overcome some of the barriers that limit computer-related technology use by preservice teacher education faculty.

Some colleges of education have designed technology integration models that promote the use and integration of computer-related technology throughout preservice teacher education programs (Kortecamp & Croninger, 1995; Mergendoller, 1994; Nelson, Andri, & Keefe, 1991; Office of Technology Assessment, 1995). There exists little data, however, on the effects these approaches have on preservice teacher education use and integration of computer-related technologies, or the use of computer-related technology by preservice teacher education faculty in general. To plan programs for teacher education faculty, there exists a need to document current levels of computer-related technology use among teacher education institutions.

Dissertation Organization

This dissertation is organized into three papers to be submitted for publication. Paper one reviews the literature that describes how computer-related technology is used and integrated into teacher preparation programs. Papers two and three report the results of two related research studies that examined the use and integration of computer-related technology by teacher education faculty from eight research one universities. The second paper assesses how the teacher education faculty in the Department of Curriculum and Instruction at Iowa State University have used and integrated computer-related technology into teacher preparation courses. Finally, the third paper describes how teacher education faculty from seven Research I universities have used and integrated these technologies into preservice education programs. The

appendices found at the end of the papers contain material relevant to that paper. All of the appendices found at the end of the dissertation pertain to the entire study. Although the last two articles describe the entire methodology and results of this research study, it may become necessary to shorten these articles to meet publication requirements.

Following the papers is a general conclusion that summarizes the results of the studies described in the papers and a list of references that were cited in the dissertation.

**TECHNOLOGY IN PRESERVICE TEACHER EDUCATION:
NEED, CURRENT PROGRAMS, AND FUTURE OPPORTUNITIES**

Paper submitted to Action in Teacher Education

Denise Schmidt

Teacher education institutions have a difficult task ahead as they prepare teachers for the schools of the 21st century. Teachers educated today will be working in technology rich environments. These teachers need to enter the profession with the necessary background to effectively use and integrate computer-related technologies to enhance teaching and learning. It is time that teacher education institutions take a leadership role in preparing teachers who are capable of using and integrating computer-related technologies in teaching and learning (Office of Technology Assessment, 1995; Olson, 1988).

Most of the research that exists in the area of use and integration of computer-related technology in education describes what has happened in K-12 schools (Becker, 1985, 1986, 1990, 1994; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990). Although there is a considerable amount of information known about the use and integration of computer-related technologies in K-12 schools, little data exists about the current state of technology use and integration in preservice teacher education programs. Colleges of education have been slow to plan for the effective use and integration of computer-related technology throughout most preservice teacher education programs (Beaver, 1990; Office of Technology Assessment, 1995). Colleges and universities are more likely to react to inservice teachers who ask for additional computer-related technology training, rather than act and prepare preservice

teachers who enter classrooms with the necessary skills to use and integrate technology in teaching and learning (Bruder, 1989). Preservice teacher education programs must begin to prepare teachers who are entering the classrooms of today to make wise and informed decisions when planning for effective uses of computer-related technology in classrooms. As this area of preservice teacher preparation evolves, isolated examples of technology integration models implemented by teacher education faculty have emerged.

This paper examines the evolution of computer-related technology use in K-12 schools and the relationship of this evolution to the current state of computer-related technology use in preservice teacher education programs. Divided into three sections, this paper includes a literature based rationale for the use and integration of computer-related technology in preservice teacher education programs, an examination of the progress K-12 schools have made to integrate computer-related technology in classrooms, and a discussion of the current state of computer-related technology use in preservice teacher education programs. Finally, the paper will include recommendations on how preservice teacher education can address the problem of the use and integration of computer-related technology within a teacher preparation program.

Rationale for Focusing on Preservice Teacher Education

The use and integration of computer-related technology in K-12 schools is well documented (Anderson, 1993; Becker, 1985, 1986, 1990, 1994; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990). Instructional uses of these technologies have evolved for nearly 20 years from using computers to reinforce rote learning activities to using computer-related

technologies as multipurpose productivity tools. This same evolution of computer-related technology use does not hold true for most preservice teacher education institutions. In most preservice teacher education programs, technology has not become a natural instructional tool used by teacher education faculty and students (American Association of Colleges for Teacher Education, 1987). In fact, teacher education institutions have been slower to adopt newer technology applications than K-12 schools (Brooks & Kopp, 1989; Office of Technology Assessment, 1995). David (1995) stated that because teacher education programs lack clear, concise programmatic goals they have been slow to infuse computer-related technology. Relating this lack of direction to technology use, Brooks and Kopp (1989) contended,

Most preservice and inservice teacher education programs have not come to grips with what it is that they should be trying to accomplish. Very often, the justification for technology is based on idiosyncratic faculty demand, not designed program demand (p. 5).

Identifying and overcoming barriers that impede the integration of computer-related technology in teacher education programs is difficult. Many of the barriers confronting preservice teacher education faculty are similar to those encountered by K-12 teachers (Becker, 1994; Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). Significant barriers still remain that limit the integration of technology into the curriculum (Sheingold & Hadley, 1990). A recent national study was conducted by the Office of Technology Assessment (1995) to gather information on technology in teacher education. Because of the random sampling procedure and the low rate of return (20%) reported for this study, these data should be viewed with caution and not be over-interpreted. Teacher education faculty who responded to the survey ranked a list of nineteen

barriers that prevented them from using computer-related technology. The highest ranked barriers were time, limited resources, attitudes, and little institutional encouragement for technology. Creative solutions and strategies to eliminate these barriers must be designed so teacher education faculty can have the opportunity to learn about the teaching and learning potential of these technologies.

Preservice teacher education programs can significantly impact future K-12 computer-related technology use by effectively preparing teachers who have the knowledge and the ability to use and integrate computer-related technology to enhance teaching and learning (Berney, 1991). For this to occur, teacher education faculty must see the need to provide experiences for themselves and their students to use and integrate technology in teacher education courses. As College of Education faculty begin to develop their own instructional uses for computer-related technology, they must learn from the approaches of K-12 schools to use and integrate these technologies. Because there has been extensive research conducted that describes the use of computer-related technologies by K-12 teachers, it may be beneficial for teacher education institutions to examine the technology integration approaches developed by K-12 schools while planning to effectively integrate technology throughout their own teacher preparation programs.

Computer-Related Technology Use and Integration in K-12 Schools

For the past two decades, more and more computer-related technologies have become accessible to K-12 teachers and students (Becker, 1990; Market Data Retrieval, 1993; Quality Education Data, 1992). During the 1980s, K-12

administrators and teachers made decisions about purchasing and using computer-related technology based upon the assumption that these technologies could improve the effectiveness of what schools were already doing, not based upon how these technologies might transform schools (David, 1995). Many K-12 school districts purchased large amounts of computer-related hardware and software, only to find that the majority of teachers were uncertain of the potential instructional uses of these technologies. Becker (1990) stated that even though computer acquisition continued to expand in most schools, only a small minority of teachers were using computers for instruction, learning, or productive work in the classroom. Although the hardware is available, it is evident that teachers need to improve upon their use of computer-related technologies to expand and enhance curricula (Office of Technology Assessment, 1995).

Many educators have chosen not to use the computer as an instructional tool in classrooms because they simply do not know how to use one. Usually, teachers are not given ample time to develop personal computer skills or to design specific classroom applications using the technology. In fact, time is often identified by teachers as the major barrier that has limited their use of computer-related technology (Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). Providing time for teachers to use and experiment with these technologies in classrooms is problematic. Inservice teachers spend the majority of their school day engaged in instruction, which leaves little time for planning and preparation (Office of Technology Assessment, 1995). Obviously, it is difficult for teachers to devote time to learning new technologies because of the daily instructional demands that are placed on them in classrooms. If computer-

related technologies are to have an impact on teaching and learning in the future, teachers must become comfortable with these technologies as tools that enhance instruction (Office of Technology Assessment, 1988). It takes a great deal of time to learn how to use computer-related technologies, and teachers are asked to not only master the technology and but also to determine how to teach with it (Brady, 1991; Novak & Berger, 1991).

K-12 computer-related technology inservice education and staff development

Still, to realize the impact that computer-related technology might have on teaching and learning in the future, helping teachers may be an important first step to helping students (Office of Technology Assessment, 1995). Perhaps the most significant factor affecting the impact of computer-related technologies in K-12 schools lies in the fact that the majority of teachers have had little or no training in the use of new technologies (Scrogan, 1989). K-12 teachers have reported that they have been inadequately trained to use computer-related technology (Fulton, 1989; Office of Technology Assessment, 1988, 1995). Kuskie suggested,

Teachers and schools must be given the time to learn how to best use existing equipment. Only with a broad knowledge of various technologies can teachers be expected to move on to new and more powerful applications. As teachers become comfortable with them, technologies will become more readily accepted into the classrooms (Bruder, 1989, p. 26).

There are not enough teachers in the K-12 schools who have acquired the necessary computer skills to utilize the technology for classroom instruction (Office of Technology Assessment, 1995; Scrogan, 1989). Some of the reasons for the shortage of teachers who are capable of using computer-related technologies

include the lack of computer-related courses offered in teacher training institutions, the inability of economically pressed school districts to hire new teachers with computer experience, and inadequate computer-related staff development programs (Office of Technology Assessment, 1988, 1995).

National surveys have been conducted to determine if computer inservice education and staff development programs were available for teachers. Data from the report, *Teachers and Technology: Making the Connection*, suggested that K-12 teachers still have very little training available for them to learn about technology and its educational uses (Office of Technology Assessment, 1995). A national probability sample was drawn that included computer coordinators from 571 public, parochial, and private schools. Less than half of these K-12 computer coordinators reported having computer courses available for their teachers either at the district or local college level. Also, findings from this study indicated that more resources had been allocated to purchase hardware (55%) and software (30%) than were allocated to provide training and support (15%) for teachers. Moreover, respondents noted that most of the computer inservice training sessions that were provided for teachers focused on learning about computers, not on learning how to teach with computers. This study indicated that teachers perceived the most effective staff development programs were the ones that included follow-up support after the initial training.

In the survey of accomplished computer-using teachers by Sheingold and Hadley (1990), results showed these teachers had taken advantage of a variety of opportunities to learn how to use computers in their classrooms. A total of 608 teachers who taught grades 4-12 responded to this survey. These teachers were nominated by their peers for their accomplishments using computers in their

teaching. When asked how or where they were trained in computer use, eighty-seven percent of these accomplished computer-using teachers indicated they were self-taught. Other computer inservice training opportunities these teachers reported were: conferences and workshops on their own time (76%), courses at local colleges (65%), inservice courses offered by their district (56%), inservice courses offered at their school (50%), courses in graduate or undergraduate training (44%), instruction from other teachers (40%), and instruction on site by consultants (38%).

Sheingold and Hadley (1990) identified another factor that contributed to the successful use of technology by the accomplished computer-using teachers. These accomplished computer-using teachers received support for using technology from their school districts. Seventy-seven percent of the teachers reported they had access to on-site computer support and advice. This support came from various sources: other teachers (69%), school computer coordinator or aide (60%), district computer coordinator (53%), and consultants (20%). These teachers worked in an environment where others were interested in using computers for instruction, and they were supported in that use.

Training teachers to successfully use computers in the classroom is a tremendous task (Office of Technology Assessment, 1988, 1995). K-12 teacher inservice training in the use of computer-related technology continues to be a major problem discouraging the acceptance of these technologies as instructional tools in schools. Successful implementation of computer-related technologies in schools has depended upon colleges of education, state departments of education, and school districts working together to provide adequate computer inservice training to meet the needs of the classroom teacher (Office of

Technology Assessment, 1995). As indicated from these survey results, the majority of teachers, however still received little or no computer training or support (Anderson, 1993; Office of Technology Assessment, 1995).

Computer training should be an ongoing process that takes place at varying levels, depending upon the teachers' responsibilities and the way the technology is to be used (Office of Technology Assessment, 1995). As more effective uses of computer-related technologies are developed, K-12 teachers will continue to need computer inservice programs that assist them in infusing these technologies into the curriculum.

Surveys of the use and integration of computer-related technology in teaching by K-12 educators

Several researchers have assessed the state of computer-related technology use in K-12 schools (Becker, 1986; 1990; 1994; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990). Results from these research studies have described how uses of the computer for instructional purposes have changed over time.

Beginning in the late 1980s, research findings reported that K-12 teachers demonstrated an awareness that computers could be used as productivity tools rather than tools used only to teach computer literacy or to reinforce skills with drill and practice applications. This finding indicated that teachers were beginning to view computers as instructional tools and not just as a supplement to instruction. Although most K-12 teachers still used computer applications such as drill and practice or tutorials to support a traditional teacher-centered model of instruction, more teachers have begun to use technology in a variety of ways to support a student-centered model of instruction (Office of Technology

Assessment, 1995). Teachers who are using technology to support a more active, student-centered model of instruction are among the more enthusiastic technology users (Office of Technology Assessment, 1995). Teachers are starting to find more integrated and varied instructional uses for computer-related technology because more teachers are using productivity tools such as word processors, databases, and spreadsheets in classrooms (Becker, 1990; Sheingold & Hadley, 1990).

Results from several research studies document the evolution of computer-related technology use in K-12 schools. Henry Becker conducted three national research studies that described the use of computer-related technology by K-12 teachers (Becker, 1984; 1986; 1990). Becker's (1990) third national survey, *1989 Computer in Education Survey*, indicated that teachers' instructional uses of computers made only modest changes between 1986 and 1989. Even though results from Becker's two earlier surveys indicated that computer assisted instruction and computer literacy dominated instructional computer use in K-12 schools, results from the third survey suggested that teachers were beginning to use computers as general intellectual and informational resource productivity tools. In this survey, secondary math teachers, science teachers, and third through sixth grade elementary teachers believed the primary function of a computer was to help students master basic facts or skills. However, the data also revealed that even though elementary teachers believed that enrichment of basic skills was still the primary use of computers, more elementary teachers viewed computers as a productivity tool than teachers surveyed in two of Becker's earlier studies. One of the most dominate trends Becker noted in K-12 computer use was the increase in use of word processing programs as a productivity tool.

Although teachers mentioned using other productivity-oriented computer programs (such as databases, spreadsheets, graphics, and publishing programs) less often than word processors in their classrooms, they expected to increase their use of these computer applications in the future.

Becker (1994) later identified 5% of the respondents from the 1989 *Computer in Education Survey*, as exemplary computer-using teachers and examined their computer-use practices. Important distinctions between how this group of computer-using teachers differed from other teachers in using and integrating computers in classrooms were identified. These computer-using teachers were found to teach in schools where other teachers used computers, supported by a broad range of staff development activities, given access to computers in schools, and given time to learn how to use computer-related technology.

Sheingold and Hadley (1990) surveyed 4th through 12th grade computer-using teachers who had been using technology for several years. Seventy-three percent of the respondents indicated they had used computers in their teaching for five years or more. Generally, these experienced computer-using teachers used computer software for content-specific applications and tools. Eighty-eight percent of the teachers reported that computers had changed their teaching methods. All of the respondents used computers as multipurpose tools that were used for a variety of instructional purposes in their classrooms. Ninety-five percent of these K-12 teachers said they used word processing and other text-processing tools. However, elementary teachers used word processors significantly less than high school teachers. Instructional software such as problem solving, tutorial and drill and practice programs were used by 89% of

the teachers surveyed. The use of analytic and information computer tools such as databases and spreadsheets increased significantly with grade level. Seventy-two percent of the teachers in this study used databases, fifty-six percent used spreadsheets, and forty-five percent used charting or graphic programs. Some of the other computer-related technologies used by teachers were desktop publishing (54%), telecommunications (49%), and multimedia (25%). As a result, important trends were identified that illustrated a shift over time in how accomplished computer-using teachers were utilizing technologies. Some teachers indicated they were no longer using some of the applications they had used in the past. Thirty percent of the teachers said they were no longer teaching programming. Also, 15% of the teachers indicated they were no longer using keyboarding, drill and practice, tutorial and recreational programs. Respondents also expressed interest in using telecommunications, multimedia, and statistical programs in the future.

In 1992, the International Association for the Evaluation of Educational Achievement conducted a national survey of computer-using teachers (Anderson, 1993). Participants were identified as computer-using teachers if they used computers sometimes with students. Data from the survey, *The 1992 Computers in Education Study*, indicated modest changes in instructional uses of computers by teachers since the late 1980s. Primarily, elementary students still were using drill and practice programs and instructional programs. Survey results showed an increased amount of time spent at the elementary level teaching keyboarding and using word processing. At the secondary level, computers were not used very often for teaching and learning in academic subject areas. In fact, secondary level respondents reported using computers only

once or twice a school year for an academic subject. Also, findings from this survey reported that time was spent teaching secondary students how to word process rather than using a word processor to support other academic goals.

Often, teachers have identified potential barriers that they believe have made it difficult for them to utilize computer-related technologies in schools. It is important to understand the barriers K-12 teachers encounter and begin devising approaches that lessen the effect these barriers have on the use and integration of computer-related technology in classrooms. Some of the barriers cited most often by K-12 teachers included the lack of time required to learn about technology and to develop lessons that used computer-related technologies, the lack of training to use computer-related technologies, inadequate amounts of computer-related technologies in schools, and inadequate financial support for additional computer-related technologies (Becker, 1991; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990).

Summary

Instructional uses of computer-related technologies in K-12 schools have evolved slowly over the last two decades. During the first part of the 1980s, the instructional uses of computer-related technologies primarily focused on computer literacy, programming, and computer assisted instruction. As the decade progressed, productivity tools such as word processing programs, databases, and spreadsheets emerged. In some situations, these multipurpose tools helped K-12 teachers focus on the development of problem solving and information handling skills. Still, in most cases K-12 technology use hasn't had the impact that it should. Although some K-12 educators are using computers as

multipurpose productivity tools to complete many instructional tasks, it still is difficult for most K-12 educators to envision how computer-related technology can be used to enhance the learning process. The research findings on computer-related technology use in K-12 schools have important implications for teacher education institutions. Preservice teachers must have experiences throughout their preparation program that prepare them to use computer-related technology for teaching and learning in K-12 classrooms. As a result, colleges of education must begin to develop and plan for the effective and efficient uses of computer-related technologies by teacher education faculty and students.

Current State of Computer-Related Technology Use and Integration in Preservice Teacher Education Programs

Given the need for using computer-related technology in K-12 schools, teacher education programs should be preparing teachers who will use and integrate these technologies to improve teaching and learning. It is becoming critical that the teachers who are entering K-12 classrooms are capable of using these technologies to expand and enhance the curriculum. In response to this need, several colleges of education have increased their efforts to plan for the effective use and integration of computer-related technology throughout their teacher preparation programs.

Technology standards for teacher education programs

Over the years, colleges of education around the country have reacted and responded to requirements placed upon their programs. Recently, colleges of education have been asked to address the issue of preparing preservice teachers to use technology. At least twenty-three state boards of education have enacted

mandates that required preservice teacher institutions to include technology training in their teacher preparation programs (Bullock, 1991). Additional states have considered such a requirement.

Besides the state mandates, several organizations have identified technology goals or objectives for teacher education programs. For example, the accreditation committee of the International Society of Technology in Education (ISTE) asked K-12 and higher education educators to develop and rank a set of computer/technology goals for preservice education (Wetzel, 1993). As a result of this process, thirteen goals for educational computing and technology were developed that focused on individual preservice teacher computer proficiency and the strategies and skills needed by preservice teachers to incorporate computer-related technologies into teaching and learning (Table 1). These thirteen ISTE Foundation Standards have since been accepted by the National Council for Accreditation of Teacher Education (NCATE). During an evaluation of a teacher education program, NCATE examiners use these thirteen goals as guidelines to evaluate the educational computing and technology components of the program.

In addition to the thirteen ISTE Foundation Standards for educational computing and technology, other organizations have developed standards that emphasize the critical need to integrate technology throughout the curriculum. For instance, some of the Curriculum and Evaluation Standards that were developed by the National Council of Teachers of Mathematics (NCTM) emphasize the importance of using technology to help students experience math (National Council of Teachers of Mathematics, 1989). According to the math

Table 1. Curriculum guidelines for accreditation of educational computing and technology programs developed by the Accreditation Committee of the International Society of Technology in Education (ISTE) (Wetzel, 1993)

ISTE Foundation Standards	
1.	Demonstrate ability to operate a computer system in order to successfully utilize software.
2.	Evaluate and use computers and related technologies to support the instructional process.
3.	Apply instructional principles, research, and appropriate assessment practices to the use of computers and related technologies.
4.	Explore, evaluate, and use computer/technology based materials, including applications, educational software and associated documentation.
5.	Demonstrate knowledge of uses of computers for problem solving, data collection, information management, communications, presentations, and decision making.
6.	Design and develop student learning activities that integrate computing and technology for a variety of student grouping strategies and for diverse students populations.
7.	Evaluate, select and integrate computer/technology-based instruction in the curriculum of one's subject area(s) and/or grade levels.
8.	Demonstrate knowledge of use of multimedia, hypermedia, and telecommunications to support instruction.
9.	Demonstrate skill in using productivity tools for professional and personal use, including word processing, database, spreadsheet, and print/graphics utilities.
10.	Demonstrate knowledge of equity, ethical, legal and human issues of computing and technology use as they relate to society and model appropriate behaviors.
11.	Identify resources for staying current in applications of computing and related technologies in education.
12.	Use computer-based technologies to access information to enhance personal and professional productivity.
13.	Apply computers and related technologies to facilitate emerging roles of the learner and the educator.

standards, technology can be used to assist students in developing problem solving and other math understandings.

Clearly, these technology standards and objectives can serve as guidelines for teacher educators as they provide computer-related technology learning experiences for their preservice teachers. Although these standards provide a framework for teacher education institutions to follow, the approaches used by institutions to insure that preservice teachers demonstrate a basic knowledge in

the use and integration of computer-related technologies vary greatly among institutions.

Approaches used to prepare preservice teachers to use computer-related technology

Two approaches have primarily been used to integrate computer-related technology throughout teacher education programs. To ensure that preservice teachers gained experience using technology in teaching and learning situations and observing instructional models of technology use, one of the following two approaches is commonly used by most teacher education institutions: (1) offering an undergraduate computer-related/instructional technology course, or (2) integrating computer-related technology throughout all teacher education courses.

Undergraduate computer-related/instructional technology course

One common approach used by most teacher preparation programs is for teacher education institutions is to offer an instructional technology or educational computing course for preservice teachers (Brownell, 1991).

Although the content and objectives for technology-specific courses vary greatly between institutions, students usually learn how to use several pieces of computer hardware and a variety of software programs. Sometimes, the students are required to create simple projects which demonstrated their ability to use the hardware and software.

In a recent study conducted by the Office of Technology Assessment (1995), the majority of colleges of education surveyed indicated they offered an educational computing, educational media or instructional technology course.

Of the institutions surveyed, slightly more than half indicated they required their preservice teachers to take such a course. Johnson and Harlow (1993) found similar results in their study of technology use in teacher education institutions throughout the United States. Approximately 85% of the teacher education institutions offered at least one educational computing course and 50% of these institutions required their students to take the course.

As indicated by the results of these studies, offering a technology-specific course in a preservice program is a typical approach used by many teacher education institutions to provide computer-related technology experiences for preservice teachers. However, recent graduates from teacher education programs were asked how well they were prepared to use technology in their teaching, and the majority of the graduates indicated they did not feel they were adequately prepared (Office of Technology Assessment, 1995). This result is an indication that one introductory course may not be enough to prepare future teachers to effectively use and integrate computer-related technologies in the classroom.

Many students who completed a technology-specific course might acquire the 'technical' expertise to use the technology, but few students exit the course with a critical understanding of how computer-related technology can be integrated across the curriculum to enhance teaching and learning. Deim (1989) suggested that three factors contributed to students' inability to transfer their technical skills of using computers to skills of integrating computers in classrooms. They were: (1) the lack of time spent on instructional applications of computers in teaching methodology classes; (2) the lack of computer use in most on-site student teaching environments; and (3) the pressure exerted on student teachers to conform to the instructional patterns of their cooperating teachers.

Often, when a technology-specific course is taught, it is viewed by most faculty as the course that will fulfill all the necessary accreditation requirements. Some authors suggested that one computer-related technology course is not enough to ensure the use of these technologies in classrooms by preservice teachers (Bitter and Yohe, 1989; Novak & Berger, 1991; Office of Technology Assessment, 1995; Strudler, 1991). Novak and Berger (1991) stated that the technology-specific course should only be used in the interim to give teacher educators time to become confident in using computer-related technology. Teacher education faculty have a tendency "to view technology as a separate type of content, rather than as something they should or could integrate into a content area" (Office of Technology Assessment, 1995, p. 185). Preservice teachers must see technology being used in all subject areas by teacher education faculty and not just a small subset of faculty who many times are considered the ones responsible for teaching the technology courses (Brownell & Brownell, 1991). In most cases teacher education faculty rely on the 'technology' faculty within the teacher education program to prepare students to use these instructional tools. It is extremely important that computer-related technology is viewed as an integral part of the entire teacher education program curriculum by preservice teacher education faculty.

Computer-related technology integration into all preservice teacher education courses

In recent years, approaches that integrate computer-related technology into teacher education programs have been developed to give students experiences using technology in all of their courses. Usually, students complete a separate technology course and apply the skills they learned in that initial course to

activities assigned in other subject-specific courses (Downes, 1992). Still, there are very few examples found in teacher education programs where preservice teachers are seeing faculty model instructional teaching methods which integrate computer-related technology (Handler & Marshall, 1992; Office of Technology Assessment, 1995).

Preservice teachers must have educational experiences throughout their preparation program that model how computer-related technologies can be used for instruction and as learning tools (Byrum & Cashman, 1993, Niess, 1991). Integrating computer-related technologies into educational methods courses has been difficult because faculty lacked training and experience using these technologies (Beaver, 1990; Office of Technology Assessment, 1995; Fulton, 1989).

Teacher education faculty have a direct influence on preservice teachers' future use of computer-related technology (Fulton, 1989). It is important that preservice teachers see technology being used in exemplary ways in all teacher education courses. Faculty who teach methods courses must model uses of computer-related technology in the content areas. Without adequate role models for students to observe in courses, it becomes difficult for preservice teachers to then design classroom activities that integrate technology on their own.

Not only should preservice teachers use computer-related technology themselves and see professors modeling the use and integration of technology in teacher education courses, they must also observe K-12 teachers using computers and related technologies in classrooms. Placing preservice teachers during their field experiences and student teacher placements in the classrooms of experienced computer-using teachers is a critical factor that strongly influences

their use of computer-related technologies in future classrooms (Office of Technology Assessment, 1995). Deim (1989) reported that the lack of K-12 technology-using teachers as role models inhibited the computer use of new teachers. The National Council for Accreditation of Teacher Educators (NCATE) standards stated that preservice teachers need experiences during practicums that include realistic opportunities to use technology under the supervision of personnel qualified to help direct the application of such material (Glenn & Carrier, 1988).

Surveys on the use and integration of computer-related technology by teacher education faculty

Computer-related technology use in preservice teacher education has been studied much less frequently than in K-12 schools. Only a few research studies exist that describe how teacher education faculty and students use computer-related technology. In this section, the results from these studies are presented.

A chapter of the report, *Teachers and Technology: Making the Connection*, focused on technology and the preparation of new teachers (Office of Technology Assessment, 1995). During the spring of 1993, ten percent of the teacher education institutions across the country were randomly selected to participate in the study. Of the 1,223 surveys mailed to the teacher education institutions, a total of 250 surveys were returned for a final response rate of 20%.

The small percentage of faculty who responded to this survey stated that their teacher education institutions did not sufficiently prepare preservice teachers to use technology in classrooms (Office of Technology Assessment, 1995). Teacher education faculty surveyed reported that there were very low levels of technology use in college of education classrooms. The majority of

teacher education faculty who responded to this survey reported they did not use information technology or model technology use to meet course objectives.

Conclusions from this study stated that simply telling preservice teachers in courses what is possible when using computer-related technology is not enough; preservice teachers must observe technology being used by faculty and must have opportunities to practice teaching with technology if they are to use these technologies effectively in classrooms.

In another study, undergraduate education majors from six midwestern universities were surveyed to examine their perceptions of the computer's role in education and the preparation of preservice teachers to teach with computers (Byrum & Cashman, 1993). In 1991, teacher education students enrolled in classes such as Microcomputers in Education or Technology in Education participated in the study. Results from this survey indicated that the majority of respondents felt prepared to use productivity tools in the classroom; eighty-nine percent of the respondents perceived they were prepared to use a word processor, seventy-one percent were prepared to use a database, and sixty-seven percent were prepared to use a spreadsheet. Although eighty-three percent of the respondents felt they were prepared to integrate computers into the curriculum, only twenty-four percent had actually been required to prepare lesson plans that integrated computer-related technology into instruction. Eighty percent of the respondents indicated they preferred using the computer as a supplement to instruction, while only thirty-six percent felt comfortable being a facilitator of instruction when using a computer. Overall, these undergraduate students perceived that they were prepared to use productivity tools, but lacked the

modeling of technology use and integration into required projects and assignments.

In 1989, both secondary education faculty and students from ninety member institutions of the American Association of Colleges for Teacher Education were asked to evaluate the effectiveness of their teacher education programs in preparing classroom teachers (Fulton, 1989). Less than one-third (29 percent) of the students graduating from these programs felt prepared to teach with computers. This finding indicated that teacher education institutions were not doing an adequate job in preparing teachers who were confident in their abilities to use a computer for instruction. Another interesting result from this study indicated that teacher education faculty and students disagreed on their perceptions of how well students were prepared to use computers in K-12 classrooms. Fifty-eight percent of the faculty thought students were well prepared to teach with computers while only twenty-nine percent of the students felt well prepared in this area. Fulton (1989) suggested that because computers were not used in their formal education, faculty from colleges of education may not understand what it means to prepare students to use computers in classrooms.

One of the largest studies of technology use in teacher education programs was conducted in 1988. Representatives from the teacher-preparation institutions, K-12 schools, and professional organizations in Michigan established a task force to address the issue of technology in preservice education (Novak & Berger, 1991). This task force surveyed each of Michigan's 32 colleges and universities that offered teacher-certification programs. Results from the survey indicated that one-third of the faculty had computers in their offices.

While sixty-one percent of the faculty reported they used computers for personal or professional tasks, only twenty-one percent used computers for instruction with preservice teachers. Seventy-five percent of the institutions reported they integrated computer experiences into teaching methodology and educational foundations courses, but none offered any type of technology-specific field experience. Around forty percent of the institutions stated that preservice teachers had the opportunity to use computer-related technology in existing field experiences.

Computer-related technology integration models used in preservice teacher education programs

Although the use and integration of computer-related technology in teacher preparation programs is not common, several universities have attempted to design approaches that integrate technology into the preservice teacher curriculum. Approaches designed by teacher education faculty have been isolated at best and in most instances have been reported by faculty at smaller colleges and universities.

One of the major goals within the teacher education program at the University of Virginia's Curry School of Education is technology integration (Mergendoller, 1994; Office of Technology Assessment, 1995). Several key factors that have contributed to the success of the Curry School of Education integration model are the support provided by administration, the development of faculty members' technology expertise, the support faculty provided their colleagues, and the technology enriched field experiences established for preservice teachers in local schools. One goal of this technology integration model is to develop a critical mass of technology-using faculty.

Lessons have been learned by the teacher education faculty and students from the Curry School of Education as a result of this technology integration model. A critical mass of faculty who were comfortable using computer-related technology was established. Now, faculty were able to assist and support each other in their attempts to integrate technology into courses they taught. However, participants from the Curry School discovered it was important to provide technology training that met each faculty member's needs. In addition, experiences from the Curry School of Education make it clear that it takes a long time, maybe 3-5 years, to prepare preservice teachers and faculty to use computer-related technology.

Five components comprise a comprehensive technology integration model for faculty development at the University of New England (Kortecamp & Croninger, 1995). The five components of the model included: 1) familiarizing faculty with hardware and software through workshops, 2) partnering with mentors, 3) developing personal projects, 4) becoming mentors, and 5) keeping current with new knowledge and technological innovations. Although this technology integration model just began in 1994, it has received positive responses from faculty and administrators involved in the program. Faculty have reported that this integration model has supported their efforts to integrate technology into teacher education methods courses.

Faculty from Bemidji State University designed a model to promote the collaborative development of technology skills that might impact technology integration by teacher education faculty (Smith, Smith, & Alexander, 1995). This four stage integration model provided teacher education faculty with the opportunity to learn new processes of technology and apply these processes to

educational settings. During the first component of this model, faculty developed background understanding of technology applications and their uses in instruction and acquired skills necessary to use technology effectively in teaching. Second, faculty developed skills in curriculum development while they focused on technology infused education and methods of modifying the curriculum to include technology. Next, participants reviewed their curriculum and course management needs with peers as they began to integrate technology into courses. Finally, the fourth component provided a forum for continuous growth and improvement in the use of computer-related technology by having faculty share their new knowledge with colleagues. Several of the positive outcomes that faculty identified as a result of this technology staff development model were an opportunity to develop their educational technology skills, to restructure their curriculum and to use resources made available after the training ends.

Teacher education faculty and administration at Southern Illinois University met to discuss the issues, problems, and possible solutions for integrating technology into teacher education at their institution (Nelson, Andri, & Keefe, 1991). Computer-using teacher education faculty were identified early and asked to participate in the development of a technology integration. Non computer-using faculty were encouraged to become involved by having their students use word processors and other tools to complete course assignments. All teacher education faculty were asked to set aside eight hours of class time each semester to focus on computer instruction. Equipment was purchased and workshops were held to support faculty who were using computer-related technology.

At Northwest Missouri State University, faculty developed a plan for constructing instructional units that focused on technology integration (Fero, 1992). This university's technology integration plan included four phases: 1) a search of the literature to summarize the technology-based educational practices in K-12 schools, 2) a determination of the facilities, hardware, and expertise available on campus, 3) a survey of teacher education faculty to determine current technology use by faculty and identify the types of technology introduced to students in teaching methods courses, and 4) a group of interested faculty was selected to help develop a unit of instruction for each of their courses.

In the Fall of 1991, a three-year technology integration plan was implemented to make computer-related technology an integral part of the teaching and learning environment in the Department of Curriculum and Instruction at Iowa State University (Thompson, Schmidt, & Hadjiyianni, 1995). A primary goal of the technology integration plan was to provide all faculty in the department with the tools they needed to make technology infusion a reality. As this integration plan evolved into its second year, a small-scale mentoring program was established in the department to assist faculty who were interested in technology integration. Individual faculty members were assigned a mentor, usually a instructional technology graduate student, who helped the faculty member learn computer programs in their content area and assisted in the design of materials to integrate technology into a faculty member's courses. Although different approaches were employed by the mentoring groups, the primary purpose of each group was to discuss, design and apply technology ideas in teacher education courses. Because this mentoring program was so successful during the second year of the integration plan, there was an overwhelming

request from faculty for additional individual support during year three of the plan. To better combine the expertise of the instructional technology graduate program with the expressed needs of the faculty, a graduate course titled, Technology in Teacher Education, was offered for doctoral students in Instructional Technology during the Spring semester in 1994. For the entire semester, each graduate students enrolled in the course assisted faculty members' efforts to use computer-related technology in classroom situations. This mentoring program has been so well received by faculty and graduate students that was continued in subsequent semesters in 1995.

The technology integration models in preservice teacher education programs described above are indicative of the growing interest and need to carefully plan for the use of computer-related technology in preservice teacher preparation programs. Each of these examples focused not only on teaching teacher education faculty to use these technologies, but more importantly, provided faculty with the opportunity to plan how these technologies might be used to expand and enhance their course content.

Conclusions and Recommendations

The potential use of computer-related technology to improve teaching and learning in K-12 schools is great, yet it has been problematic because typically, teachers have not been given the time or the opportunities to learn how to use and integrate these technologies throughout the K-12 curriculum (Office of Technology Assessment, 1995). Preservice teacher education institutions can assist K-12 schools efforts to use computer-related technologies by preparing future teachers who are capable of using and integrating these technologies in

teaching and learning. Because so little is known about the use and integration of computer-related technology in preservice teacher education programs, it will be important for colleges of education to examine the successes and failures encountered by K-12 schools while attempting to use and integrate computer-related technology (Becker, 1985, 1986, 1990, 1994; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990). Further analysis of these efforts will assist teacher education faculty as they begin to plan and develop uses of computer-related technology that enhance teaching and learning.

Preservice teacher education institutions are slowly beginning to use and integrate computer-related technology throughout teacher preparation programs. Traditionally, the approach used by most teacher preparation institutions had been to offer an instructional technology course where preservice teachers could learn to use computer-related technology (Brownell, 1991). Although the majority of colleges of education offer a technology specific course, this approach is not seen as a solution to the problem of technology integration because these courses tend to focus on how to use the technology rather than how to integrate the technology to enhance teaching and learning.

Similar to the renewed interest of K-12 schools to emphasize the integration of computer-related technology in classrooms (Becker, 1994; Office of Technology Assessment, 1995; Sheingold & Hadley, 1990), there has been increased interest by preservice teacher educators to search for ways to infuse computer-related technology throughout all teacher education courses (Byrum & Cashman, 1993, Niess, 1991). Although this approach has gradually gained the support by some teacher education faculty at selected institutions (Kortecamp & Croninger, 1995; Mergendoller, 1994; Thompson, Schmidt, & Hadjiyianni, 1995),

computer-related technology integration throughout a teacher preparation program is a daunting challenge for most institutions.

Many of the challenges preservice teacher education faculty have encountered in their attempts to use and integrate computer-related technology are similar to barriers K-12 teachers have experienced. It is well documented in the K-12 literature that teachers need time to learn how to use computer-related technology successfully (Becker, 1990, 1994; Brady, 1991; Office of Technology Assessment, 1995; Sheingold & Hadley, 1990); preservice teacher education faculty have also stated that they lack the necessary time to become more knowledgeable about computer-related technology (Novak & Berger, 1991; Office of Technology Assessment, 1995). Teacher education faculty can be certain that learning how to use and integrate computer-related technology will take time, as it will probably be several years before they are comfortable using these technologies with students in their courses. As noted by Becker (1994) and Sheingold and Hadley (1990), it often takes K-12 teachers more than five years to become accomplished computer-using educators.

Peer mentoring was a theme that frequently emerged from the preservice teacher education literature on existing technology integration models (Kortecamp & Croninger, 1995; Mergendoller, 1994; Thompson, Schmidt, & Hadjiyianni, 1995). It is interesting to note that this theme has not appeared as frequently in the literature that described methods used to support K-12 teachers use of technology. Other teacher preparation institutions that are interested in integrating computer-related technologies throughout the teacher preparation program, will want to note the positive results reported by institutions that have

used such an approach. Although it is a labor intensive approach, it seems several teacher education programs are finding it worthwhile.

In recent years, studies have been conducted to identify successful computer-related technology integration programs in K-12 schools (Mergendoller, 1994; Office of Technology Assessment, 1995). Although studies of exemplary teacher education programs that use and integrate computer-related technology are needed, it also seems there is an immediate need for more information that describes what is happening in teacher education institutions around the country. Additional research is necessary to describe the current state of computer-related technology use and integration by teacher education faculty.

**IMPLEMENTATION AND ASSESSMENT OF
A COMPUTER-RELATED TECHNOLOGY INTEGRATION MODEL
FOR PRESERVICE TEACHER EDUCATION FACULTY**

A paper to be submitted to the Journal of Teacher Education

Denise Schmidt

Teacher education institutions are currently faced with the challenge of providing assistance and support for teacher education faculty who are interested in using and integrating computer-related technology into teaching and learning (Beaver, 1990; Kortecamp & Croninger, 1995; Smith, 1994). Although several research studies have described how K-12 school districts and teachers have addressed specific computer-related technology issues in education (Becker, 1985, 1986, 1990; Kirby, Wilson & Smith-Gratto, 1988; Office of Technology Assessment, 1995; Sheingold and Hadley, 1990), little has been done to assess how teacher education faculty use and integrate computer-related technology throughout a teacher preparation program (Schrum, 1994). Because of the need to establish successful technology integration models that support teacher education faculty in their efforts to use and integrate computer-related technology, it is important to assess the current state of faculty development in these areas.

This paper examines the results of a research study designed to describe and assess the use and integration of computer-related technology by teacher education faculty from the Department of Curriculum and Instruction at Iowa State University. This department has completed a three-phase program designed to facilitate the integration of technology into the teacher education curriculum. Along with reporting the current state of the use and integration of computer-related technology by a teacher education faculty who have

emphasized this area, the results of this study assisted in the development of technology integration plans that support teacher education faculty who are advancing in this area.

Introduction

Colleges of Education are currently preparing teachers who will teach in the rapidly changing classrooms of the 21st century. As those classrooms are redesigned, one issue that all educators must confront is how computer-related technologies can be used to support and enhance these learning environments (Sheingold, 1991; Strudler, 1994). To prepare future teachers for these classrooms, it is not enough to think in terms of only what computer competencies they should have when they graduate (Beichner, 1993). Issues such as the articulation of an educational rationale for technology use, the alignment of technology use with curriculum goals, and the impact of technology on student learning must be addressed. These issues indicate that many teacher education institutions will have to rethink and restructure their preservice and inservice programs to accommodate the changing roles that teachers and learners will assume in 21st century K-12 classrooms. It is the responsibility of teacher education programs to prepare "teachers who are comfortable with the technology, appreciate its potential, and are able to create their own applications" (Barron & Goldman, 1994, p. 81). With this responsibility comes the realization that this is an overwhelming task for teacher educators to accomplish.

Since the early 1980s, K-12 education has faced a similar dilemma: providing opportunities for inservice teachers to learn about the use and integration of computer-related technologies in classrooms. Although the literature suggests that K-12 school districts have provided inservice

opportunities for their teachers to learn how to use the technology, very few support structures exist that help teachers sustain this use. Teachers require a number of different approaches to support their use of computer-related technology. In addition to inservice programs aimed at developing technology technical skills, teachers need hands-on learning opportunities, time to experiment, easy access to equipment, and access to support personnel who can assist them with teaching practices and curriculum integration (Office of Technology Assessment, 1995).

While K-12 schools and school districts continue to plan for technology use and integration, teacher education institutions typically have not done the same (Schrum, 1994). As suggested by Brooks and Kopp (1990), much attention has been given by K-12 schools to the preparation of inservice teachers to use computer-related technology; but little has been done by teacher education institutions to help their faculty use and integrate computer-related technology or to prepare preservice teachers who are capable of using computer-related technology in classrooms.

Undergraduate teacher-training institutions are not taking a convincing or focused leadership role in identifying solid evidence about the applications of technology to teacher training. The best and most consistent exposure for teachers to classroom-relevant technologies is often at the inservice or private sector level. In short, the information age has yet to significantly influence teacher training. (Brooks & Kopp, 1990, p. 499)

Several teacher education institutions identified the need to improve upon their efforts to promote the use and integration of computer-related technology by teacher education faculty and students (Fiason, 1994; Kortecamp & Croninger, 1994). Preservice teachers are entering schools "inadequately

prepared to integrate technology effectively into their teaching repertoires" (Davis, 1994). It is evident that many preservice teachers feel they lack the necessary skills and experiences to use computer-related technology for teaching and learning. In fact, not only must preservice teachers understand the potential of technology, they must understand how to use technology in the classroom with students (Barron & Goldman, 1994; Soloman, 1992). To develop this vision, preservice teachers must have educational experiences that model how computer-related technology can be used for instruction and as learning tools throughout their preparation program (Byrum & Cashman, 1993).

One desirable goal for many teacher education programs is for technology to become a natural part of the teaching and learning environment for all faculty (Bruder, 1989; Nelson, Andri, & Keefe, 1991). According to Handler and Marshall (1992), all faculty should assume the responsibility of modeling appropriate uses of technology as an instructional tool for students. When the computer becomes a necessary tool for the faculty member, then its use in the classroom is the next logical step (Johnson & Harlow, 1993).

In the report, *Teachers & Technology: Making the Connection*, three levels of technology use in teacher education are identified: 1) discussion/demonstration, 2) technology practice, and 3) professional practice (Office of Technology Assessment, 1995). The order of these levels suggests a developmental model of technology use in teacher education; the progression through which preservice teachers are guided to acquire basic skills as well as sophisticated models of classroom integration of technology (Table 1). The first level of use is referred to as discussion or demonstration. At this level, a professor might discuss how a spreadsheet is used in a high school math class or

Table 1. Three levels of technology use in teacher education (Office of Technology Assessment, 1995)

Level of Use	Type of Use	Description of Use
Level One	Discussion/Demonstration	Professor demonstrates or discusses how technology can be used in K-12 classrooms.
Level Two	Technology Practice	Preservice teachers learn how to use technology through hands-on experiences and practice.
Level Three	Professional Practice	Preservice teachers observe K-12 teachers using technology and/or practice teaching with technology.

demonstrate how to use a database in an elementary classroom to an entire class of preservice teachers. The second level of technology use provides preservice teachers with hands-on technology practice. For example, preservice teachers in a reading methods course might spend time in a computer lab reviewing and examining several elementary word processing programs. Viewed as the most complex level of technology use in teacher education, the professional practice level focuses on integration of technology into K-12 classrooms. At this level, preservice teachers are either observing technology-based learning in K-12 classrooms, designing lesson plans that integrate technology, or teaching with technology in classrooms. For example, to complete an assignment for a science teaching methodology course, a preservice teacher designs a lesson plan where elementary students work in cooperative groups to solve problems encountered in a simulation and then teaches this lesson to sixth graders. Ultimately,

preservice teachers design curriculum materials that infuse technology and practice teaching with technology in classrooms.

In this paper the results of a research study that assessed the current state of teacher education faculty use and integration of computer-related technology in the Department of Curriculum and Instruction at Iowa State University are examined. The article includes the following sections: 1) description of the evolution of technology use by the teacher education faculty and students, 2) research methodology, 3) results of the study, and 4) a discussion of the conclusions and implications of the study.

Evolution of Technology Use and Integration by Preservice Teacher Education Faculty and Students

In the fall semester of 1991, the Department of Curriculum and Instruction in the Iowa State University College of Education was formed by merging the Departments of Elementary Education and Secondary Education. This department consisted of 33 full time faculty members, 34 faculty members on joint appointment, 1025 undergraduate elementary education majors, and 500 undergraduate secondary education majors. In addition, there were more than 150 students pursuing graduate degrees in Special Education, Elementary Education, or Curriculum and Instructional Technology. The undergraduate and graduate Instructional Technology programs in this department traditionally have been known for preparing preservice and inservice teachers to use computer-related technology for teaching and learning.

The initial development of the Instructional Technology program began in the late 1960s with the offering of an educational media course for preservice teachers. The primary purpose of the Instructional Technology program was to

teach a one credit hour methods laboratory that provided opportunities for teacher education students to learn how to use educational media they would encounter in schools. Over the last fifteen years, the Instructional Technology program has evolved to include several additional instructional technology courses and a minor in educational computing for undergraduates. In addition to these course offerings, a technology integration plan was designed to help all faculty use and integrate computer-related technology in educational foundations, teaching methods and field experience courses.

Instructional and computer-related technology courses offered in the department

Several undergraduate instructional technology courses are taught by faculty in the Department of Curriculum and Instruction. Beginning the Fall semester of 1994, all teacher education students were required to take a three credit hour introductory instructional technology course. Prior to this semester, teacher education students were required to take the one credit educational media course and then had the option to take a three credit hour educational computing course. Although many teacher education students enrolled in both courses, there were still some students who completed the educational media course only. Because many of the teacher education faculty thought it was essential for teacher education graduates to develop skills in using both computer-related technologies and educational media, the three credit hour instructional technology course was designed.

The purpose of this instructional technology course is to introduce students to computer-related technology and educational media used in K-12 schools. Offered at the freshman and sophomore level, the goal of this course is to develop students' computer skills and introduce them to curriculum

integration concepts and current issues related to technology use in schools. Upon completion of the introductory course, students who are interested in gaining additional expertise in the area of educational computing can enroll in other instructional technology classes offered by the department.

Three upper level undergraduate educational computing courses offered in the Department of Curriculum and Instruction provide a series of learning experiences that focus on the integration of technology and the design of technology-based instruction. One course, Using Microcomputers in the Classroom, examines the issues related to the integration of computer-related technology in schools. Students in this course are required to design classroom applications for computer-related technologies that expand and enhance the K-12 curriculum. In another course, Design and Development of Computer Assisted Instruction, students learn how to use various multimedia software programs. Throughout this class, students explore the potential of using multimedia to enhance learning while they design a multimedia project for use with K-12 students. With the completion of the statewide fiber optic network [i.e., Iowa Communications Network (ICN)], the course, Theory and Practice of Distance Education, was developed to introduce students to distance education technology and the instructional techniques used for teaching distant learners. Collectively, these courses are components of the undergraduate educational computing minor offered by the Curriculum and Instruction Department.

Undergraduate minor in educational computing

In response to the need to prepare preservice teachers to use and integrate computer-related technology throughout the curriculum, a minor in educational computing was designed for undergraduate students at Iowa State University.

Established in 1984, this minor is offered by the Department of Curriculum and Instruction in the College of Education. Approximately one hundred students majoring in early childhood education, elementary education, and/or secondary education are currently enrolled in the educational computing minor. All students in the minor are required to take at least sixteen credit hours of coursework in educational computing and related areas (Table 2). It should be noted that nine of the credit hours within the educational computing minor cannot be used to meet any other college or university requirement.

Over the past ten years, the educational computing minor requirements have changed to prepare undergraduate students enrolled in the program to use and integrate technologies in future classrooms. Initially, the minor included four instructional technology courses, one cognitive psychology course, and one computer science course. Currently, the educational computing minor includes six courses: five instructional technology courses and one computer science course. In addition to the introductory instructional technology course and the three upper level technology courses, students enroll in one computer programming course offered by the Computer Science Department. Also, students are required to participate in a technology field experience. During this pre-student teaching technology field experience, preservice teachers have the opportunity to work in classrooms with area K-12 computer-using educators.

Topp (1993) surveyed Iowa teachers who graduated from the Iowa State University teacher preparation program from 1986 to 1990 to assess the effectiveness of the technology preparation program for all teacher education graduates. Surveyed were a range of students, including those who earned the educational minor, as well as those who completed the one credit educational

Table 2. List of required courses for the educational computing minor offered by the Department of Curriculum and Instruction in the College of Education

Course No.	Course Name	Credits
El. Ed./Sec. Ed. 201	Introduction to Instructional Technology	3
El. Ed./Sec. Ed. 280A	Pre-Student Teaching Experience Teacher Aide	1
El. Ed./Sec. Ed. 280B	Pre-Student Teaching Experience Ed. Computing	1-3
Sec. Ed. 302	Using Microcomputers in the Classroom	3
Sec. Ed. 401	Theory and Practice of Distance Education	2
Sec. Ed. 403	Design and Devel. of Comp. Assisted Instruction	3
Com. Sci. 107 or Com. Sci. 207	Applied Comp. Programming or C Programming I	3 or 3

media course only. Over two-thirds of the respondents who graduated from the teacher education program prior to 1990 reported that they were inadequately prepared to use computer-related technologies for teaching and learning. The survey yielded two other significant findings: the majority of the respondents indicated that a computer-related course should be required for all preservice teachers and that computer-related technologies should be modeled by

instructors in all education courses. These results served as a catalyst for the restructuring of the teacher preparation program in the Department of Curriculum and Instruction. The aim of this restructuring was to provide hands-on technology experiences for students, reinforced by the modeling of technology integration by teacher education faculty.

Prior to 1991, teacher education students were the primary focus of attempts to facilitate teacher use and integration of computer-related technologies in teaching methodology courses and K-12 schools. Little had been done within the Department of Curriculum and Instruction to assist and support faculty who were using and integrating computer-related technology. In 1991, a technology integration plan was designed to empower all teacher education faculty to improve their computer-related technology skills while focusing on integrating these technologies into their courses.

A technology integration plan for preservice teacher education faculty

In the Fall of 1991, a three-year technology integration plan was implemented to make computer-related technology an integral part of the teaching and learning environment in the Department of Curriculum and Instruction at Iowa State University. A critical factor in support of the technology integration plan was the designation of technology integration as a three-year department goal by the Curriculum and Instruction faculty. One primary goal of the technology integration plan was to provide all faculty in the department with the tools they needed to make technology infusion a reality. Faculty accessibility to technology tools was viewed as a critical factor to the successful implementation of the three year technology plan.

During the first year of the technology integration plan (1991-1992), the primary goal was to improve faculty access to computer-related technology and to provide support in using various types of computer hardware and software (Thompson, Schmidt, & Hadjiyianni; 1995). One of the first steps taken to improve access was to provide all faculty members in the Department of Curriculum and Instruction with a computer in their office. A mobile teaching station equipped with a computer, CD ROM player, overhead projector and color LCD panel was provided to enable faculty to teach with technology that otherwise would not have been available for instruction. To provide computer access at home and at professional meetings, several laptop computers were purchased for short term faculty checkout.

Little attention was given to helping faculty use the computer for instructional purposes during the first year of the technology integration plan; much attention was given to helping faculty learn the basic operations and functions of the computer and assisting them in learning how the computer could be used to complete their own work. In response to faculty suggestions, first year workshops were conducted by faculty members on topics such as word processing, database management, spreadsheets, and the Internet. To introduce faculty to other software programs available in the department, a computer station called "Software of the Week" was created. This computer station was located in the College's Instructional Resources Center and provided faculty and students with the opportunity to review and learn software programs available in the Center's software collection.

The integration of computer-related technology into education courses by interested faculty members was the major focus during the second year (1992-

1993) of the technology integration plan. A small scale mentoring program was established in the department to assist faculty who were interested in technology integration. The mentors involved in this program were primarily instructional technology graduate students. Individual faculty members were assigned a mentor who helped them learn computer programs in their content area and assisted in the design of materials to integrate technology into their courses. Although different approaches were employed by each mentoring group, the primary purpose of each group was to discuss, design and apply technology ideas in teacher education courses.

Although technology integration was identified as the major focus of the second year, it was important to continue and build upon many of the activities that were begun in year one. Numerous workshops on topics requested by faculty continued. By this time, there was a need to deliver workshops for faculty with different levels of expertise. For example, two workshops were offered on spreadsheets, one for advanced users and one for beginners. Also, a local area network containing an electronic mail system was established in the department during year two. To improve instructional access to technology, a model mathematics and science classroom funded by the National Science Foundation was designed to support the integration of technology into the mathematics and science teaching methodology courses. In this classroom, faculty and students have access to a teacher computer work station and six student computer work stations; each station includes a computer, CD ROM player, laser disc player, monitor and still video camera.

Increased use of computer-related technology by faculty was evident during the first two years of the technology integration plan; but by the third year

(1993-1994), the use of computer-related technologies had become vital and natural tools for many of the faculty, staff, and students in the department. Much of departmental business was conducted using computer-related technology. Local communication between faculty and staff was enhanced through the use of electronic mail, and connections with other professionals worldwide were made using the Internet.

Due to the success of the year two mentoring program, there was an overwhelming request from faculty for additional individual support during year three of the technology integration plan. Providing enough mentors for interested faculty members was not easily accomplished due to the number of staff required for such an endeavor. Traditionally, the Curriculum and Instructional Technology doctoral program in the department has attracted a number of students who have a strong interest in technology integration in education. This was seen as an opportunity to combine the expertise of the doctoral students enrolled in the this instructional technology graduate program with the needs of the faculty. As a result, a graduate course titled, Technology in Teacher Education, was offered for doctoral students in Instructional Technology during the 1994 Spring semester. The basic purpose of the course was to review and discuss the research literature on the use of technology in teacher education and to provide field experiences for those enrolled in the course.

As expected, there were more faculty who volunteered for the mentoring program than graduate students enrolled in the course. Several of the graduate students offered to mentor more than one professor, so all faculty who requested assistance received help from a mentor. Throughout the semester, graduate students worked with faculty members who taught educational foundations,

teaching methodology, special education, and foreign language education courses. As the graduate student mentor learned about the course content taught by the faculty mentee, the faculty member learned more about how to use technology to expand and enhance their course content. As a result of the mentoring program, several teacher education faculty use computer-related technology regularly in their classes and require their undergraduate and graduate students to use computer-related technology to complete class assignments.

Method

This descriptive research study was designed to assess the use and integration of computer-related technology by teacher education faculty in the Department of Curriculum and Instruction at Iowa State University. Data gathered from this study describe faculty past and current proficiency in using computer-related technology, faculty attitudes toward computer-related technology, and factors identified by the faculty that affect their use and integration of computer-related technology. A second study that involved teacher education faculty from seven other Research I universities was conducted concurrently with this study; the results of which are reported in Schmidt (1995). The following sections summarize the research procedure, the development of the instrument, and the description of the respondents.

Research procedure

In April 1995, thirty five, full-time faculty members in the Department of Curriculum and Instruction were sent a questionnaire along with a cover letter and a return envelope (Appendix A). Each questionnaire was assigned an

identification number to monitor the rate of return. Two weeks after the initial mailing of the questionnaire, a postcard reminder was mailed to non-respondents asking them to complete and return the completed survey (Appendix B). Another two weeks after the postcard reminder, a second copy of the questionnaire was sent to the remaining non-respondents.

Twenty-two teacher education faculty in the Department of Curriculum and Instruction returned the initial questionnaire. After the postcard reminder and second questionnaire were sent to non-respondents, an additional six surveys were returned. A total of twenty-eight faculty members responded to the survey for a final response rate of 80%.

Development of the instrument

The seven page questionnaire, *Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, was developed to gather descriptive information about the current state of computer-related technology use by teacher education faculty. Since there has been considerable research conducted on K-12 teachers in this area, several questionnaires used for national and state studies on K-12 computer-related technology use and integration were examined (Becker, 1986, 1990; Minnesota Department of Education, 1989; Office of Technology Assessment, 1988; 1995; Schmidt, 1991; Sheingold & Hadley, 1990; Topp, 1993). Common computer-related technology themes were identified in these surveys and used to create the framework for a questionnaire that would survey preservice teacher education faculty. Themes that emerged from previous studies were faculty proficiency in using computer-related technology, faculty attitudes toward computer-related technology, and how faculty integrate computer-related technology into their courses.

The questionnaire was developed by the researcher with assistance from other university faculty members. Note, the researcher was a faculty member teaching in the Department of Curriculum and Instruction. Faculty assisting in the development of this instrument included the Dean of the College of Education, the chair of the Department of Curriculum and Instruction, a professor in research and evaluation, two professors in the Department of Curriculum and Instruction and a teacher education professor from the University of Nebraska, Omaha. Several meetings were held between the researcher and these university faculty members to discuss the objectives for the study and to develop the survey instrument. Using the suggestions and recommendations offered by these faculty members, an instrument was designed to assess preservice teacher education faculty proficiency in using computer-related technology, attitudes toward computer-related technology and methods for integrating computer-related technology into courses.

A draft of the survey was pilot-tested with twelve teacher education faculty at a midwestern university. These teacher education faculty members were asked to complete the questionnaire and to make comments about any items they perceived as unclear. Also, each respondent documented the time required to complete the survey. Final revisions were made to the questionnaire based on comments submitted by these teacher education faculty. Survey revisions included rewording a few of the items, adding one question to the background section, and deleting one item from the integration section of the questionnaire.

The final seven page questionnaire, *Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, contained 82 items

that were organized into five sections: (1) background information, (2) current proficiency in using computer-related technology, (3) past proficiency in using computer-related technology, (4) attitudes toward computer-related technology, and (5) integration of computer-related technology into a teacher education program.

Design of section one: Background information

The purpose of section one of the survey was to obtain descriptive background information about the respondents. Items in this section requested information about respondents' gender, age, years of higher education teaching experience, academic rank, and courses taught. Also, respondents were asked to indicate if they had a computer in their office and if so, how many years the computer had been in their office.

Design of sections two and three: Current and past proficiency using computer-related technology

Sections two and three of the survey asked teacher education faculty to rate their current and past proficiency in using various instructional technology equipment and computer-related technology applications. Portions of the surveys, *Iowa Survey of Computer-Related Technology Use by K-12 Teachers* (Schmidt, 1991) and *Survey of K-12 Computer-Related Technology Use by Iowa State Graduates* (Topp, 1993) were used in the development of items for these two sections of the survey. In both sections, respondents used a Likert scale to answer twenty-five items that indicated their current and past proficiency in using these technologies. At the end of section three, an additional three items were included so the respondents could rate their overall personal proficiency,

their departmental peers' overall proficiency, and their students' overall proficiency for using computer-related technology.

Design of section four: Attitudes toward computer-related technology

Teacher education faculty attitudes toward computer-related technology were determined in section four. The fifteen items in this section were taken from Schmidt (1991). Respondents were asked to indicate to what extent they agreed or disagreed with each item using the five point scale as described by Henerson, Morris and Fitz-Simmons (1978).

A rotated varimax factor analysis was conducted to measure the unifying concepts that characterized the responses of the fifteen attitude items. Two factors emerged from this analysis. Items included in the first factor related to the general attitude of faculty toward using computer-related technology, and items included in the second factor related to the confidence of faculty in using computer-related technology (Appendix C).

A Cronbach alpha reliability coefficient was obtained for each of the attitude factors to test the internal consistency of the attitude items. The general attitude factor had a reliability coefficient of $r = .86$, and the confidence attitude factor had a reliability coefficient of $r = .82$. Both coefficients are within the range (.47-.98) of accepted standard attitude scales (Borg & Gall, 1989).

Design of section five: Integration of computer-related technology into a teacher education program

A review of the research literature on factors that impact the use and integration of computer-related technology provided the basis for the fifth section of the survey (Beaver, 1990; Davis, Willis, Fulton, & Austin, 1995; Davis, 1993; Handler & Marshall, 1992; Office of Technology Assessment, 1995; Strudler,

1991). This section contained seven questions; each question was designed to identify various factors that influenced the integration of computer-related technology into preservice teacher education programs. Two questions in this section asked the respondents to rank a list of items in order of importance. The other five items were open-ended questions that required a written response from each respondent. One of the five open-ended questions provided space for the respondents to write additional comments, suggestions, or concerns. Appendix H contains a complete list of responses to that question.

Two questions in section five gave respondents the opportunity to rank in order of importance a list of items. The first question asked respondents to rank the top five reasons from a list of seventeen items why they used or would use computer-related technologies in their courses. The second question gave respondents a list of thirteen barriers and asked them to rank the top five barriers that most impeded their use of computer-related technology. For both of these questions, space was provided for respondents to add their own reasons or barriers.

Four additional open-ended questions were included to address various computer-related integration topics. One open-ended question encouraged each respondent to describe the one factor that helped him/her learn how to integrate computer-related technologies into courses. Another open-ended question required the respondents to describe, in order of importance, how support for using computer-related technology had been made available to them. Also, respondents were asked to suggest additional types of support that would be helpful to them in their attempts to integrate computer-related technology.

Finally, respondents were to describe briefly their single most successful use of computer-related technology in teaching.

Description of the sample

Surveys were mailed to thirty-five, full-time faculty members in the Department of Curriculum and Instruction at Iowa State University. All faculty who teach undergraduate and/or graduate teacher education courses were selected to participate. The final response rate was 80% as a total of twenty-eight faculty members responded to the survey.

Of the teacher education faculty who responded, 78.6% were female and 21.4% were male. Slightly less than half of the respondents (42.9%) were between the ages of 50-59 years. One fourth of the respondents (25%) were between the ages of 40-49 years and almost eighteen percent (17.9%) of the faculty were between 30-39 years. Less than ten percent of the respondents (7.1%) were under the age of 30 years. The same percent of respondents (7.1%) reported they were over the age of 60 years. All but one of the respondents indicated they had a computer in their office.

Respondents were asked to indicate their years of teaching experience in higher education and their academic rank. Forty-two percent of the respondents (42.9%) had over 16 years of university teaching experience. Slightly over ten percent (10.7%) of the faculty reported they had between 6 and 15 years of experience. Forty-four percent of the respondents (44.5%) had less than 5 years of teaching experience in higher education; this may be attributed to the fact that almost forty percent of the respondents (39.3%) were full-time temporary instructors in the department. Less than one third of the faculty (32.1%) were full

professors. Twenty-one percent (21.5%) and seven percent (7.1%) were assistant and associate professors respectively.

Participants were asked to indicate all of the types of courses they taught in the Department of Curriculum and Instruction. Sixty percent of the respondents (60.7%) taught at least one undergraduate teaching methodology course. Less than one-fourth of the respondents (21.4%) taught at least one undergraduate educational foundation course. Almost eighteen percent of the respondents taught at least one undergraduate subject-specific course (17.9%), while the same percentage of respondents indicated they taught an instructional technology course (17.9%). Fourteen percent of the respondents (14.3%) were involved in teaching at least one special education course and slightly over twenty percent (21.4%) supervised field experiences for teacher education students. Over fifty percent of the respondents (53.6%) indicated they regularly taught graduate courses in the department.

Results

Faculty responses to the questionnaire, *A Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, were used to compute descriptive information about: (1) current and past proficiency using computer-related technology, (2) teacher education faculty attitudes toward computer-related technology, and (3) factors that affect the use and integration of computer-related technology by teacher education faculty. Results from the survey are reported below.

Current and past proficiency in using computer-related technology by teacher education faculty

The purpose of the second and third sections of this questionnaire was to assess teacher education faculty proficiency in using computer-related technology. Participants were asked to respond to items that addressed their current and past (five years ago) proficiency for using instructional technology equipment and computer-related technology applications. The following Likert scale was used to measure faculty proficiency: 1 = No proficiency; 2 = Little proficiency; 3 = Moderate proficiency; and 4 = High proficiency.

Current and past proficiency in using instructional technology equipment

On the questionnaire, preservice teacher education faculty were asked to report their perceived current proficiency in using ten different types of instructional technology equipment (Figure 1). When asked about their general use of the computer, respondents' mean response was 3.46 which indicated they perceived they had between moderate to high proficiency in using the computer. All teacher education faculty who responded to this question indicated they had moderate or high proficiency in using the computer; no respondent rated their proficiency about their general use of the computer lower than moderate. The next highest individual item responses in this section included 2.86 for using a modem and 2.75 for using both a CD ROM and a liquid crystal display (LCD); these responses indicated that faculty felt they had close to moderate proficiency using this hardware. Respondents perceived they had close to little proficiency using a distance education system (2.39), a laser disc player (2.25), a still video camera (2.11), and a scanner (1.93).

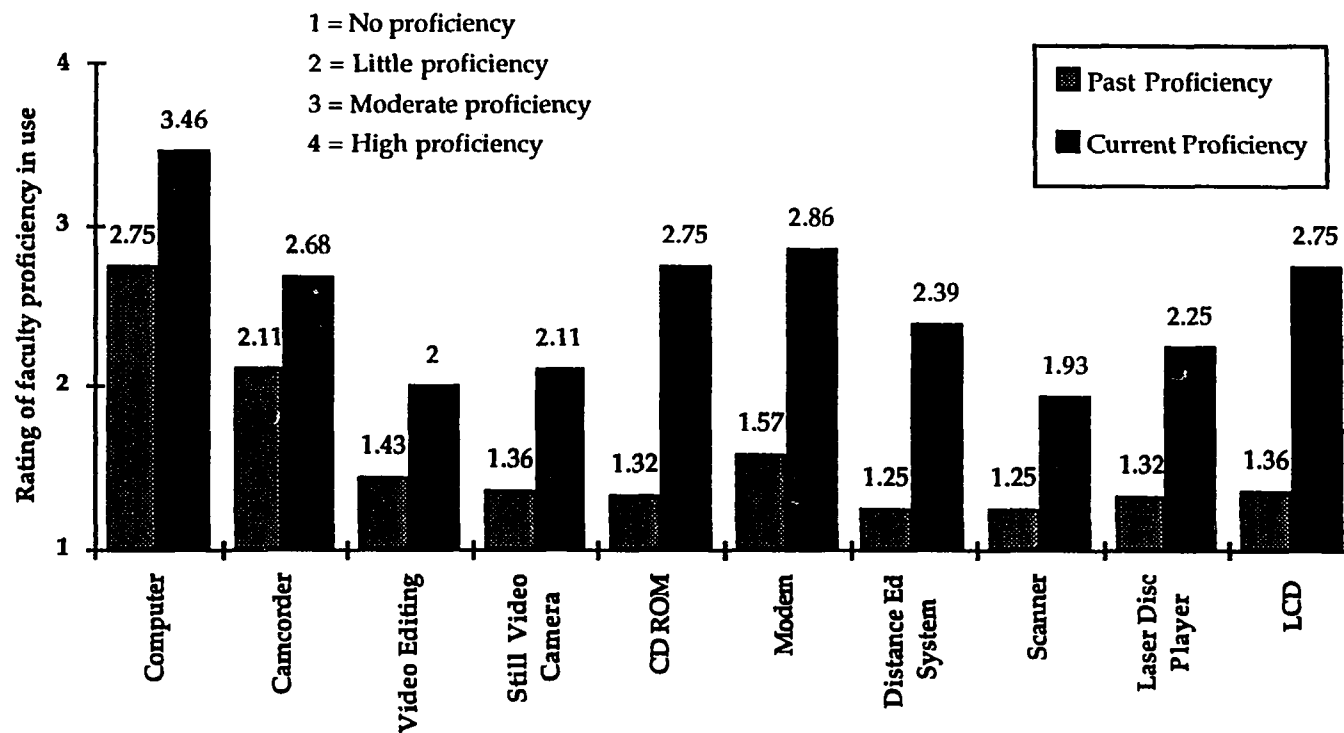


Figure 1. Mean responses of Iowa State respondents for proficiency in using instructional technology equipment

In addition to rating their current proficiency in using computer-related technology, respondents were asked to report their past proficiencies by indicating how proficient they were in using various instructional technology equipment five years ago (during the 1989-1990 academic year). Dependent t-test results indicated that the current and past proficiency in using instructional technology equipment by Iowa State teacher education faculty were significantly different for using all of the instructional technology equipment listed on the survey (Tables 5-17). Faculty went from having no proficiency to having close to moderate proficiency in using a CD ROM, a modem, and a liquid crystal display (LCD). This increase in faculty proficiency may be due to the workshops that were provided for faculty who were interested in using these technologies. Respondents improved from having almost no proficiency to having at least a little proficiency in using a still video camera, a laser disc player, and a distance education system. Although inservice workshops were available for faculty to learn how to use these types of technology, faculty may not have identified a purpose for using the technology for teaching and learning and as a result didn't consider it important to learn how to use the equipment.

Current and past proficiency in using computer applications

Respondents were asked to indicate their perceived current proficiency in using fifteen computer applications. Word processing had the highest mean response with 3.56. Fifty-six percent of the respondents reported they had high proficiency using word processing, while forty-four percent reported moderate proficiency. Two communication technology applications had the next highest means. Local Area Network Communication (LAN) (i.e., QuickMail) had a mean of 3.46 and Internet or Bitnet followed with a mean of 3.07; these means

indicated faculty perceived they had moderate proficiency using these applications. It should be noted that over sixty five percent (67.9%) of the respondents reported they had high proficiency using Local Area Network Communication (LAN).

Respondents indicated they had between moderate and little proficiency using several of the computer tool applications. The mean current proficiency scores for using the following tool applications were: desktop publishers (2.86), spreadsheets (2.71), databases (2.61), presentation programs (2.5), grading programs (2.46), and statistical programs (i.e., SPSS, Statview) (2.43). Programming received the lowest mean response for the proficiency items; the mean response of 1.46 indicated respondents had close to no proficiency using a programming application.

Figure 2 presents the mean responses for current and past proficiency using each of the fifteen computer applications listed on the questionnaire. It should be noted that most faculty still perceive little proficiency using simulations (1.82), problem solving software programs (1.93), and hypermedia programs (2.11).

A dependent t-test procedure was used to determine if any differences existed between current and past proficiency in using computer applications by the Iowa State teacher education faculty. There were significant differences found between past and current proficiency scores for all but one of the computer applications listed (Tables 18-32). Respondents reported relatively no proficiency in using programming in both the past and the present. The most significant differences between past and current proficiency means occurred in using LAN communication and the Internet. Respondents had almost no proficiency in

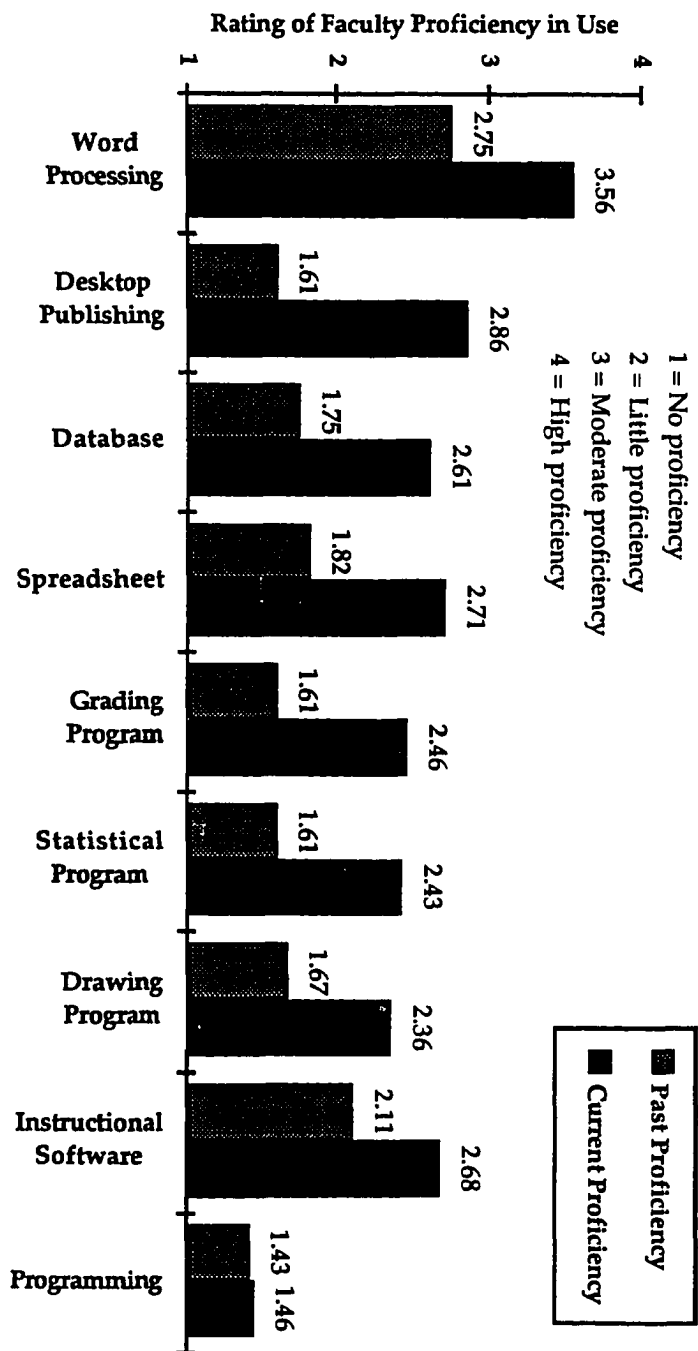


Figure 2. Mean responses of Iowa State respondents for proficiency in using computer-related technology applications

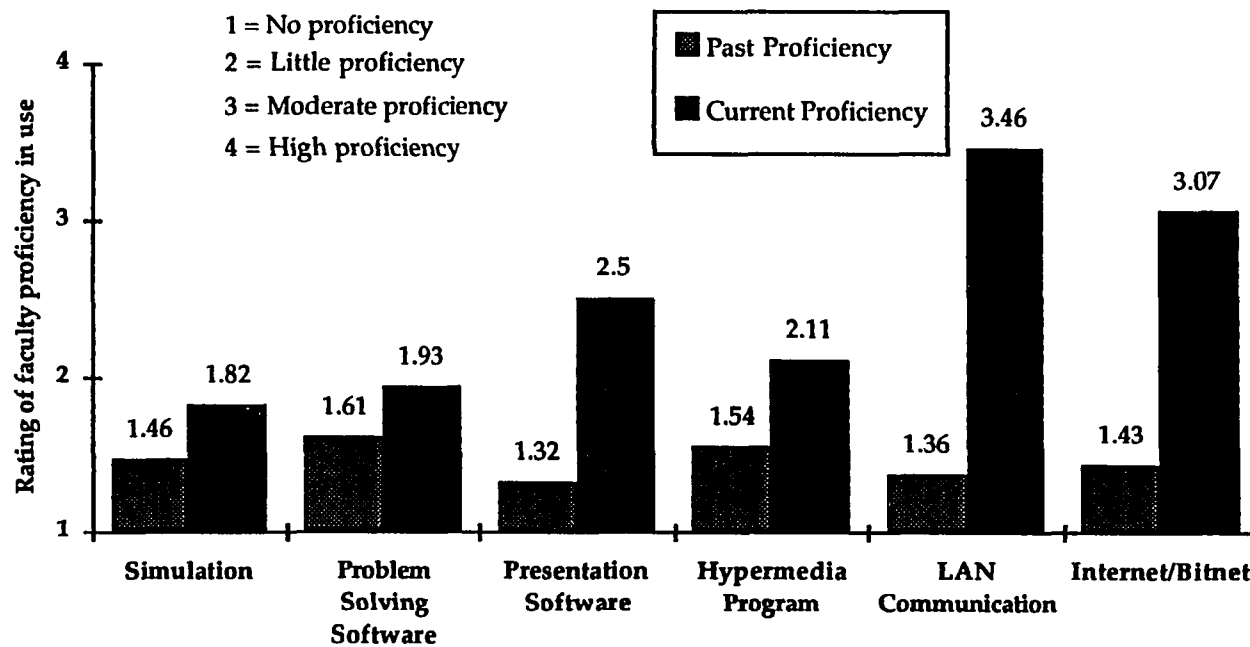


Figure 2. (cont.)

using these technologies five years ago and currently rate themselves as having between moderate and high proficiency.

Rating of personal, departmental peers, and students overall current proficiency in using computer-related technology

After rating their current and past proficiency in using a variety of computer-related technologies, the teacher education faculty were asked to rate their current overall personal proficiency in using computer-related technology. In addition to rating their overall personal proficiency, respondents were asked to rate their perception of departmental peers' and students' current proficiency in using computer-related technology. To rate these proficiencies, teacher education faculty used the following Likert scale: 1) Very inadequate; 2) Inadequate; 3) Adequate; 4) More than Adequate; and 5) Outstanding.

Teacher education faculty from Iowa State University rated their overall personal proficiency (3.48) in using computer-related technology higher than the proficiency of their departmental peers (3.18) and students (3.14) (Figure 3). Thus, faculty rated their overall personal proficiency between adequate and more than adequate, while they rated their peers and students proficiency in using computer-related technology closer to adequate. Although fourteen percent of the faculty (14.8%) reported their personal proficiency as outstanding, they rated only three percent of their peers' (3.7%) and students' (3.6%) proficiency as outstanding (Figure 3). No respondent rated their own proficiency, their peers' proficiency or their students' proficiency as being very inadequate.

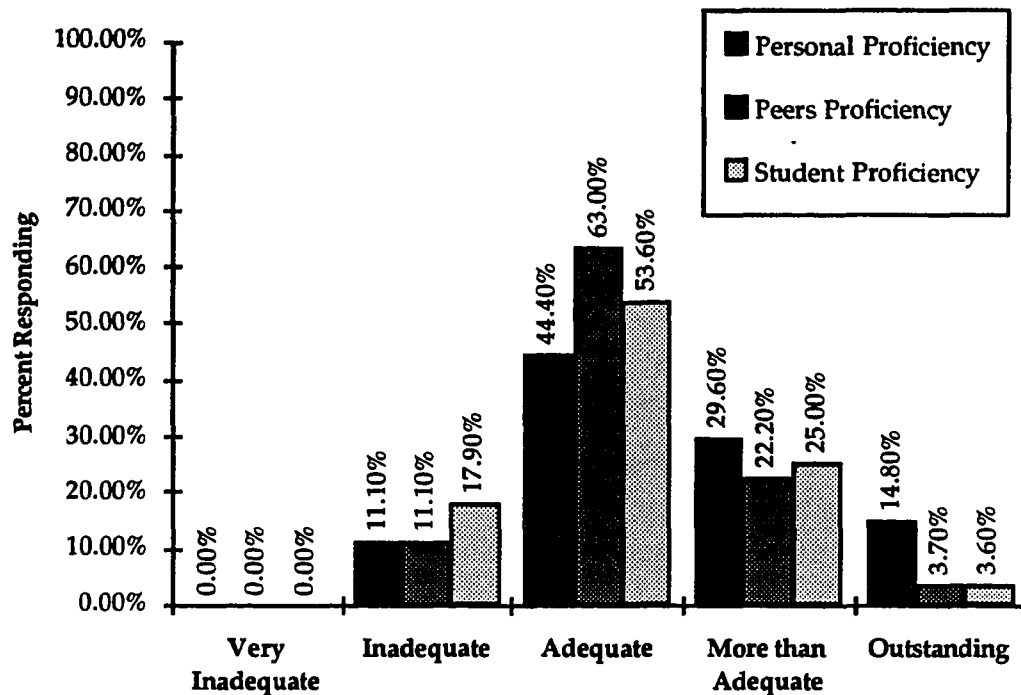


Figure 3. Iowa State respondents' rating of their overall personal proficiency, their peers' proficiency, and their students' proficiency in using computer-related technologies

Preservice teacher education faculty attitudes toward computer-related technology

The purpose of section four of the survey was to assess teacher education faculty attitudes toward computer-related technology. There were fifteen items on the survey that measured teachers attitudes toward computer-related technology. The Likert scale for these items was as follows: 1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree. Five attitude items that were negatively worded were reversed scored (i.e., 1=5, 2=4, 4=2, 5=1).

After a rotated varimax factor analysis was conducted, two attitude factors emerged from the fifteen attitude items on the survey. The two attitude factors that emerged were a general attitude toward computer-related technology factor and a confidence toward using computer-related technology factor.

The average response for the general attitude factor toward using computer-related technology by teacher education faculty at Iowa State was 4.25. Thus, the respondents' mean response for this factor was closer to agree than strongly agree. Within this factor, the highest mean response was 4.63 for the item, "I feel it is important for educators to be able to use computer-related technology"; ninety-six percent (96.3%) of the respondents agreed or strongly agreed with this statement. Other individual items in the general attitude factor with high mean responses were: "computers are valuable tools used to improve the quality of education" (4.57), "computer-related technologies should be used to improve learning throughout the curriculum" (4.56), and "a computer is a very important instructional tool" (4.44). For the general attitude factor, the lowest mean response was 3.86 for the item, "In the future I will integrate computer-related technology much more for teaching." The mean response for this item was closer to agree than to undecided.

The second attitude factor, confidence toward using computer-related technology, had an average mean response of 4.04. This mean indicated that teacher education faculty were confident in using computer-related technologies. There were several items in this factor with a mean score above 4.0; "I think computers make my professional work easier" (4.48), "I am comfortable using computer-related technologies for my own work" (4.22), and "I have confidence in using a computer to complete my work" (4.15). The item, "It has not been a

struggle for me to learn how to successfully use a computer," had the lowest mean response (3.46) for this factor. The mean response for this item was between undecided and agree.

Integration of computer-related technology throughout a teacher education program

The integration of computer-related technology by teacher education faculty was the emphasis of the last section of the questionnaire. Respondents were asked to rank the top five reasons why they use or would use computer-related technology in their courses and to rank the top five barriers that impeded their use of computer-related technology in courses. Also, faculty were asked to identify factors that helped them learn how to integrate technology into their courses, support provided for them to use technology, and additional support needed for their use of technology. Finally, respondents were asked to describe their most successful use of computer-related technology in teaching.

One factor that helped teacher education faculty learn how to integrate computer-related technology

Respondents were asked to describe one factor that helped them learn how to integrate computer-related technologies into their courses. This was an open-ended question on the survey designed to encourage respondents' own responses. Fifty-eight percent of the teacher education faculty who completed the survey responded to this question.

After reviewing all of the open-ended responses, the researcher categorized the responses into themes. Two Iowa State professors were asked to categorize these data according to the thematic categories suggested by the researcher. Their ratings were then compared to the researchers and the

responses were grouped into categories. A list of all of the open-ended responses for this question from the teacher education faculty appear in Appendix D.

Twenty-three of the twenty-eight Iowa State teacher education faculty who responded to the survey answered this question. The most frequent factor cited by respondents for helping them learn how to integrate computer-related technology into their courses was participating in the peer mentoring program with graduate students (Table 3). Over twenty percent (22.7%) of the faculty responses indicated that this mentoring program had helped them with technology integration. The second factor most frequently cited by respondents was learning about technology integration by personal exploration; four faculty members mentioned this factor. Next, teacher education faculty reported that attendance at workshops and conferences and assistance from other faculty members helped them learn about technology integration. Other factors that assisted faculty with technology integration included: identifying the need to integrate to support teaching and learning, observing technology use modeled by others, and providing easy access to hardware and software.

Table 3. Iowa State faculty responses indicating what one factor helped them learn how to integrate computer-related technology into their courses

Categories of faculty responses	Number of responses for each item
Participated in peer mentoring program with graduate students	5
Learned about technology by personal exploration	4
Received assistance from another faculty member	4
Attended workshops and conferences	2
Identified the need to integrate to support teaching and learning	2
Observed technology use modeled by others	2
Provided easy access to hardware and software	2
Other	1

Reasons why teacher education faculty use or would use computer-related technology in the courses they teach

Teacher education faculty were asked to rank the top five reasons why they use or would use computer-related technology in the courses they teach. Seventeen reasons for using computer-related technology were listed on the survey. Two lines were provided so faculty could write other reasons not included on the list. Respondents ranked the top five reasons by placing a 1 beside the most important reason for using computer-related technology, a 2 beside the next most important reason, and so on up to 5. Before the data were analyzed, the ranked items were reverse scored (i.e., 1=5, 2=4, 4=2, 5=1). These data were summed to rank order the faculty responses. The most important reason for using computer-related technology as identified by the respondents would then have the largest sum.

Thirteen of the seventeen possible responses received a ranked score from at least one Iowa State teacher education faculty member (Table 4). The highest ranked reason for using computer-related technology in courses was "helps prepare students to teach in future school settings." Over one third of the respondents (33.3%) ranked this reason for using computer-related technology as the most important. In fact, all but six respondents ranked this factor in the top five. "Models effective uses of technology for teaching and learning" was the second highest ranked reason for using computer-related technology. Almost half of the respondents (44.4%) ranked this item as the first or second most important reason for using computer-related technology in courses. Note that three of the top six most important reasons for using computer-related technology in courses as ranked by the respondents mentioned student learning; "Encourages active student learning," "enhances student learning," and "assists

Table 4. Iowa State faculty responses indicating the reasons for using computer-related technology in courses

Ranking	Reasons for using computer-related technology	Number of respondents	Minimum	Maximum	Sum
1	Helps prepare students to teach in future school settings	21	0	5	74
2	Models effective uses of technology for teaching and learning	19	0	5	65
3	Encourages active student learning	16	0	5	46
4	Enhances student learning	12	0	5	45
5	Encourages me to try new things in my teaching	14	0	5	42
6	Assists student learning	11	0	4	35
7	Enables learning experiences otherwise impossible	15	0	5	33
8	Addresses multiple student learning styles	9	0	5	31
9	Addresses expectations of K-12 school administration and teachers	4	0	3	9

Table 4. (continued)

Ranking	Reasons for using computer-related technology	Number of respondents	Minimum	Maximum	Sum
10	Addresses a departmental goal	6	0	3	8
11	Facilitates individualized instruction	4	0	3	7
12	Addresses personal satisfaction	1	0	5	5
13	Addresses expectations of college students	1	0	2	2
14	Addresses expectations of administration	0	0	0	0
15	Addresses the demands of university reward structure	0	0	0	0
16	Addresses the expectations of departmental peers	0	0	0	0
17	Supports university mission	0	0	0	0
18	Other	0	0	0	0

student learning" were ranked third, fourth and sixth respectively. Three lower ranked reasons for using computer-related technology were: "facilitates individualized instruction," "addresses personal satisfaction," and "addresses expectations of college students." Five of the eighteen items listed did not receive a response from any of the faculty who completed the survey.

Barriers teacher education faculty encounter in using or trying to use computer-related technology in the courses they teach

Teacher education faculty at Iowa State considered lack of time to learn new technologies as their greatest barrier to using computer-related technologies in courses (Table 5). Sixty-four percent of the respondents ranked this item either first or second from the list of barriers. Most respondents still see a need for more equipment, software, and training in order to use computer-related technologies. "Lack of available equipment," "Lack of training to use new technologies," and "Lack of software for courses" were ranked second, third and fifth respectively. Items such as "Lack of administrative support for using technology" and "Students are not prepared to use technologies" were two of the barriers ranked lowest by faculty; that is, Iowa State teacher education faculty, did not view these as significant barriers to their use of computer-related technologies in courses.

Means of support available to teacher education faculty for using computer-related technology

Teacher education faculty were asked to identify the different ways that support for integrating computer-related technology in teaching had been provided for them. Respondents were asked to describe how this support was provided by listing their responses in order of personal importance. After

Table 5. Iowa State faculty responses indicating the barriers they encountered in using computer-related technologies

Ranking	Barriers encountered in using computer-related technology	Number of respondents	Minimum	Maximum	Sum
1	Lack of time to learn new technologies	20	0	5	80
2	Lack of available equipment	18	0	5	62
3	Lack of training to use new technologies	17	0	5	60
4	Lack of personal comfort with using technology	10	0	5	30
5	Lack of software for the courses you teach	7	0	4	22
6	Not enough class time, too many topics	10	0	5	21
7	Other	7	0	5	20
8	Not applicable to the course subject matter	3	0	4	10
9	Lack of technical support for using technology	4	0	3	9
10	Students do not feel technology is important for learning course content	2	0	4	7
11	Lack of administrative support for using technology	3	0	4	6
11	Students are not prepared to use technologies	2	0	4	6
13	K-12 schools do not expect teachers to use technologies	1	0	3	3
14	Technology does not enhance student learning	0	0	0	0

Table 6. Iowa State faculty responses indicating what support was available for them to integrate computer-related technology in teaching

Categories of faculty responses	Number of responses for each item by level of importance			Weighted Totals
	1	2	3	
Workshops/seminars provided within the college	3	7	1	37
Easy access to hardware and software	5	1	1	29
Support from faculty member(s)	3	3	0	24
Support from a graduate student(s)	3	2	0	19
Technical support provided within the college	3	0	0	15
Financial support for technology hardware and software purchases	1	3	1	15
Other	2	0	4	14
Peer mentoring program with graduate students	2	1	0	13
Support from department administration	1	1	0	8
No support provided	1	0	0	5
Technical support provided outside of the college	0	1	0	3

reviewing all of the responses, the items were placed in categories by the researcher. Each item was assigned a weighted score for analysis purposes. For example, if an item was listed first by a respondent it was assigned a value of 5, if it was listed second it was assigned a value of 3, and if it was listed third it was assigned a value of 1. The total score for each means of support item was calculated by multiplying the number of responses by the weighted score and then adding all of those scores for each item. An entire list of the responses from the Iowa State University teacher education faculty can be found in Appendix E.

Teacher education faculty listed a variety of ways that support had been provided for them to integrate computer-related technology in teaching (Table 6). Workshops and seminars on computer-related technology provided within the college and easy access to hardware and software were the two most important means of support identified by respondents. Support provided by other

individuals was also important to faculty members; respondents indicated that the support they received from a faculty member, a graduate student or an individual who was in the departmental mentoring program was important to them. Thus, these responses indicate that faculty consider many of the support mechanisms available within the department or college as being important to them for using computer-related technology in teaching.

Additional support requested by teacher education faculty for integrating computer-related technology into teaching

After respondents listed the types of support that were available to them, they were then asked to suggest additional types of support that would be useful in their efforts to integrate computer-related technology in teaching. In response to this question, respondents were asked to suggest three additional types of support and list them in order of importance. To report these data, each open-ended response was placed into a category identified by the researcher. Again, each response was assigned a weighted score according to its order of importance as determined by each respondent. Appendix F lists each open-ended response given by the teacher education faculty.

The teacher education faculty at Iowa State University listed several types of additional support for using computer-related technology would be useful to them (Table 7). Although teacher education faculty indicated earlier that they received support through such mechanisms as workshops and easy access to hardware and software, their responses to this question identified a need to continue to provide more support in these two areas. "Provide easier access to hardware and software" and "Provide additional workshops/seminars within the college" were listed as the top two types of additional support for faculty use

Table 7. Iowa State faculty responses indicating what type of additional support would be most useful to them

Categories of faculty responses	Number of responses for each item by level of importance			Weighted Totals
	1	2	3	
Provide easier access to hardware and software	5	2	3	34
Provide additional workshops/seminars within the college	3	2	2	23
Continue/expand peer mentoring program with graduate student(s)	2	3	0	19
Acquire more hardware and update hardware in place	3	1	1	19
Provide more time	3	0	1	16
Organize small mentoring groups for interested faculty	2	2	0	16
Other	2	2	0	16
Provide access to computer and/or modem at home`	3	0	0	15
Purchase more software	0	1	3	6
Provide opportunities to watch others model technology	1	0	0	5
Share information about new software and hardware purchased	0	1	0	3
Share technology journal articles with faculty	0	1	0	3
Provide more hardware for student checkout	0	1	0	3

of computer-related technology in teaching. Also, several respondents indicated the need to continue and to expand the departmental peer mentoring program with graduate students. Other additional support items mentioned by faculty included: "Acquire more hardware and update hardware in place," "Provide more time," "Organize small mentoring groups," and "Provide access to computer and/or modem at home."

Most successful use of computer-related technology in teaching as described by teacher education faculty

Finally, teacher education faculty were asked to describe their most successful use of computer-related technology in teaching. To analyze these data,

methods of teaching with and about technology as identified by the Office of Technology Assessment (1995) were used. In the report, *Teachers & Technology: Making the Connection*, three types of technology use in teacher education were identified: 1) discussion/demonstration, 2) technology practice, and 3) professional practice.

Twenty-two of the twenty-eight faculty members who completed the entire survey described their most successful use of computer-related technology in teaching. The entire list of faculty responses can be found in Appendix G. Although faculty were asked to describe their single most successful use of technology in teaching, some respondents listed more than one successful use of technology in their courses. Of the thirty-two uses of technology that were described by faculty; twelve (37.5%) were classified as level one use or discussion/demonstration, fourteen (43.7%) were classified as level two use or technology practice, and six (18.8%) were classified as level three use or professional practice. Level one faculty responses included "Showing the different software that is available in my subject area" and using "Powerpoint for selected presentations assisted in (the) clarity and pacing of the content delivery." The second level of technology use involves hands-on technology practice by preservice teachers, so responses such as "Going to the computer labs to learn about the writing process and experience how technology can facilitate this process" and having "Students use interactive software (i.e., problem solving and simulation) as well as laser disks, CD ROM software in my discipline" were classified as level two use. Only six faculty responses were classified as level three or professional practice use of technology. Examples of responses for this level of use include "The use of Internet/distance education to connect

preservice teachers to the 'real' classroom," an "email activity in the math methods course to encourage the development of preservice teachers' ability to help elementary students learn problem solving skills," and "Students use technology in 'micro' lesson taught in my class (e.g., LCD panel, CD ROM)."

Conclusions and Implications

This paper describes both implementation and assessment of a program designed to facilitate the infusion of technology throughout a teacher education program. In general, the results indicate that the faculty is improving both in its knowledge of computer-related technologies and its ability to integrate these technologies into teaching. Results suggest, however, that even in a department that has emphasized technology infusion, progress is slow and that it takes time for faculty to move to a high level of technology use in teaching.

Like K-12 teachers, teacher education faculty cite time as the biggest barrier to their use of computer-related technology. Time is reportedly the number one barrier most teachers face while attempting to infuse technology into the classroom (Becker, 1990; Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). As faculty become more interested in using computer-related technologies, they will have to realize that it not only takes time to experiment with the technology, but they will need even more time to design classroom applications to use in their classrooms. Even the most highly motivated teachers often require three to five years before they feel comfortable enough to infuse a specific technology into their teaching practices (Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). As the results of this study indicate, it has taken several years for faculty to become proficient in using some

of these computer-related technology applications and it will take even longer for them to integrate the technology into their teaching. Thus, a supportive environment where teacher education faculty are encouraged and expected to use computer-related technology in their teaching is necessary when developing a critical mass of technology-using educators.

Although respondents indicated that the department had supported their efforts to use and integrate computer-related technology by providing easy access to hardware and software, they still listed access as a barrier. Even though faculty members indicated they had easy access to computer-related technology, the respondents perceived they still needed greater and easier access to equipment. Becker (1994) stated that no matter what resources were accessible to K-12 teachers, both exemplary and other computer-using educators reported never having enough access to computers and related software. As technology use is modeled by teacher education faculty and integrated into the learning environment for students, it is inevitable that this will increase the need to have greater access to hardware and software. Faculty will need more access to accomplish their instructional goals and students will need greater access to complete assignments and to practice teaching with technology. Strong efforts to provide access to newer computer-related technology for faculty and students will insure that both groups have the adequate tools necessary to create active learning environments that promote the ability to think critically, communicate effectively, and solve problems efficiently.

These data indicated an overall improvement between respondents' current and past proficiency for using most instructional technology equipment and computer applications. In these areas, the general use of a computer and the

use of the word processor were the only two items that respondents' reported having close to high proficiency. This finding seems to indicate that faculty might be introduced and encouraged to use some of the other computer productivity tools that are available to them. It is important that faculty perceive that the computer is a multipurpose educational tool that can be used by them or their students for a variety of learning tasks.

The fact that faculty indicated little proficiency in their ability to use simulations is a revealing finding. Simulations provide a powerful opportunity for using computer-based learning to provide authentic experiences otherwise not available for students (Thomas & Hooper, 1991); these capabilities have the potential to be especially effective in teacher education. The response of the faculty surveyed in this study, however, suggests that helping teacher education faculty identify and use simulations in their teaching needs to become a higher priority for teacher education programs interested in technology infusion. Currently, simulations exist that can assist teacher education faculty in preparing teachers for future classrooms. Some simulations create authentic teaching environments that provide preservice teachers with opportunities to conduct lessons or control student behaviors (DeFalco & Strang, 1995). Providing assistance for teacher education faculty who are interested in infusing these types of simulated experiences into their courses could strengthen a preparation program for preservice teachers.

The majority of faculty (78.6%) who responded to this survey described their most successful use of computer-related technology in teaching. Clearly, the 32 responses given by faculty indicated that several individuals in the department had at least attempted to infuse technology in teaching. However,

most of the faculty were either using the technology themselves for discussion or demonstration purposes (37.5%) or letting preservice teachers learn how to use computer-related technology through hands-on experience and practice (43.7%). Although it is important to provide experiences for students at these two levels of technology use, it seems critical that preservice teachers are observing technology being integrated throughout the K-12 curriculum and that preservice teachers are designing and teaching lessons that integrate technology. According to these data, few faculty members (18.8%) were providing opportunities in their courses for preservice teachers to practice teaching with technology in learning situations or to observe K-12 teachers using technology in classrooms. In the future, teacher education faculty must provide more opportunities for preservice teachers to experience integrating technology into K-12 teaching and learning situations.

One-on-one mentors for faculty seems to be one promising approach to helping faculty effectively use the time they do have to learn about technologies. Faculty frequently mentioned the departmental peer mentoring program as a factor that influenced their use and integration of computer-related technology. In fact, respondents cited the peer mentoring program as being the number one factor that helped them learn how to integrate computer-related technology into their courses. When suggestions were given for ways to provide additional support, several faculty members again mentioned the peer mentoring program. It appears from these responses that this mentoring program was highly successful for faculty. It should be noted that the mentor assigned to each faculty member not only had sufficient technical expertise, but in most cases he/she had the pedagogical expertise required to assist faculty members in designing and

implementing successful classroom integration activities. This mentoring program has evolved to the point where individual faculty members who were involved in the first and second year of the program are now becoming mentors for their faculty colleagues.

Overall, the attitude of the teacher education faculty toward computer-related technology was positive. Clearly, the mean response teacher education faculty reported for the general attitude factor (4.25) indicated a positive attitude. Respondents also were fairly confident in their abilities to use computer-related technologies. Yet, the lowest mean response reported for an individual item in the confidence factor, "It has been a struggle for me to learn how to successfully use a computer," indicates that technology use and integration is not easily accomplished.

In conclusion, this article has identified some important technology integration themes related to improving the use and integration of computer-related technology throughout a preservice teacher education program. It will be important to continually assess the progress made by this faculty as they continue using and integrating technology in their courses. Even though this process is slow, teacher education faculty must be patient as they begin to discover new and innovative ways to integrate computer-related technology into their courses.

Appendix: Dependent T-Test Tables 8-32

Table 8. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a computer

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	2.75	1.18	4.21	<.0001*
Current Proficiency	28	3.46	.51		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a computer at .05.

Table 9. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a camcorder

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	2.11	1.13	4.77	<.0001*
Current Proficiency	28	2.68	1.16		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a camcorder at .05.

Table 10. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using video editing equipment

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.43	.88	3.44	.002*
Current Proficiency	28	2.00	1.19		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using video editing equipment at .05.

Table 11. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a still video camera

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	2.11	.83	3.95	.001*
Current Proficiency	28	1.36	1.13		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a still video camera at .05.

Table 12. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a CD ROM

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.32	.72	7.58	<.0001*
Current Proficiency	28	2.75	1.01		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a CD ROM at .05.

Table 13. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a modem

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.57	.98	6.09	<.0001*
Current Proficiency	28	2.86	1.21		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a modem at .05.

Table 14. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a distance education system

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	27	1.25	.70	5.43	<.0001*
Current Proficiency	27	2.39	1.10		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a distance education system at .05.

Table 15. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a scanner

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.25	.64	4.38	<.0001*
Current Proficiency	28	1.93	1.02		

* $p < .05$.

t-test indicates there is no significant difference between the past and current proficiency for using a scanner at .05.

Table 16. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for a laser disc player

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.32	.77	5.23	<.0001*
Current Proficiency	28	2.25	1.11		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a laser disc player at .05.

Table 17. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a LCD panel

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.36	.83	7.15	<.0001*
Current Proficiency	28	2.75	1.08		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a LCD panel at .05.

Table 18. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using word processing

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	2.75	1.14	4.20	<.0001*
Current Proficiency	28	3.61	.57		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using word processing at .05.

Table 19. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using desk top publishing

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.61	.99	6.58	<.0001*
Current Proficiency	28	2.86	.97		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using desk top publishing at .05.

Table 20. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a database

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.75	1.01	4.50	<.0001*
Current Proficiency	28	2.61	1.03		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a database at .05.

Table 21. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a spreadsheet

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.82	1.05	4.58	<.0001*
Current Proficiency	28	2.71	1.09		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a spreadsheet at .05.

Table 22. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a grading program

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.61	1.07	4.87	<.0001*
Current Proficiency	28	2.46	1.04		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a grading program at .05.

Table 23. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a statistics program

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.61	.88	4.26	<.0001*
Current Proficiency	28	2.43	1.10		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a statistics program at .05.

Table 24. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a drawing program

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	27	1.67	1.11	4.08	<.0001*
Current Proficiency	27	2.41	1.12		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a drawing program at .05.

Table 25. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using programming

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.43	.84	.44	.663
Current Proficiency	28	1.46	.79		

* $p < .05$.

t-test indicates there is no significant difference between the past and current proficiency for using programming at .05.

Table 26. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a simulation

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.46	.94	2.79	.01*
Current Proficiency	28	1.82	.74		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using word processing at .05.

Table 27. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using problem solving software

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.61	.83	3.10	.004*
Current Proficiency	28	1.93	1.02		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using problem solving software at .05.

Table 28. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using instructional software

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	2.11	1.67	3.44	.002*
Current Proficiency	28	2.68	1.09		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using instructional software at .05.

Table 29. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using presentation software

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.32	.67	7.23	<.0001*
Current Proficiency	28	2.50	1.11		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using presentation software at .05.

Table 30. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using a hypermedia program

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.53	.96	3.62	.001*
Current Proficiency	28	2.11	1.13		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a hypermedia program at .05.

Table 31. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using LAN communication.

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.36	.73	11.22	<.0001*
Current Proficiency	28	3.46	.92		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using LAN communication at .05.

Table 32. Descriptive statistics and t-test results for Iowa State respondents' current and past proficiency for using the Internet/Bitnet

Test	N	Mean	S.D.	t-Value	P-Value
Past Proficiency	28	1.43	.84	9.14	<.0001*
Current Proficiency	28	3.07	.77		

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using the Internet/Bitnet at .05.

**USE AND INTEGRATION OF COMPUTER-RELATED TECHNOLOGY BY
PRESERVICE TEACHER EDUCATION FACULTY IN SELECTED
RESEARCH I UNIVERSITIES**

A paper to be submitted to the Journal of Computing in Teacher Education

Denise Schmidt

The examination of the use and integration of computer-related technologies in K-12 classrooms has been a common theme in education literature in recent years (Becker, 1985, 1986, 1990, 1994; Office of Technology Assessment, 1988, 1995; Sheingold & Hadley, 1990). In contrast and somewhat ironic is that fact that little information exists that documents how colleges of education have attempted to address computer-related technology integration within teacher preparation programs. It is clear that K-12 technology use could be impacted significantly if preservice teacher preparation programs attempted to prepare future teachers who have the knowledge and the ability to use and integrate computer-related technology to enhance teaching and learning (Berney, 1991). Several sources have suggested that colleges and universities that have teacher preparation programs must take a leadership role in preparing preservice teachers to use computer-related technology (Brooks & Kopp, 1989; Espinoza & McKinzie, 1994; Office of Technology Assessment, 1995).

The purpose of this study was to determine the current state of computer-related technology use and integration in preservice teacher preparation programs in large research institutions. This article is divided into three parts. First, a description of technology integration efforts currently taking place in preservice teacher education programs is presented. Next, the results of a study about the state of computer-related technology use and integration at several

Research I universities are reported. Finally, recommendations about how preservice teacher education institutions might continue to plan for the effective use and integration of computer-related technology throughout their teacher preparation programs are provided.

Current State of Computer-Related Technology Use and Integration in Preservice Teacher Education Programs

Few teacher education institutions have incorporated technology throughout their teacher preparation programs (Turner, 1989; Vagle, 1994). Successful integration of technology in K-12 schools depends upon the ability of teacher education faculty to do so. The next three sections of this paper will describe (1) the survey results on the use and integration of computer-related technology in preservice teacher education programs, (2) the approaches used by teacher education institutions to prepare preservice teachers to use computer-related technology, and (3) several computer-related technology integration models used in preservice teacher education programs.

Surveys on the use and integration of computer-related technology by preservice teacher education faculty

The use and integration of computer-related technology has been studied much less frequently in preservice teacher education programs than in K-12 schools. Only a few studies have been conducted that described the use and integration of technology by preservice teacher education faculty.

In the report, *Teachers and Technology: Making the Connection* (Office of Technology Assessment, 1995), a description of the state of technology use in teacher education is provided. Consisting of several research studies, the report included the results of a survey of teacher education institutions. The survey

results of teacher education faculty indicate that in general teacher education institutions have not sufficiently prepared preservice teachers to use technology in classrooms. Preservice teacher education faculty who responded to the survey reported very low levels of use in teacher education courses. Also, faculty communicated that they rarely modeled the use of technology in their classes. These findings indicated that the majority of teacher education faculty needed support when integrating technology into the courses they taught.

In another study conducted in 1991, teacher education students from six midwestern universities were surveyed to examine their perceptions of the computer's role in education and the preparation of preservice teachers to teach with computers (Byrum & Cashman, 1993). All of the respondents were undergraduate students enrolled in a computer-related/instructional technology course at one of the six universities. The majority of respondents perceived themselves as prepared for using computer productivity tools in the classroom and felt prepared to integrate computers into the curriculum. However, respondents believed themselves most prepared to use drill and practice software in the classroom and preferred using computers to supplement classroom instruction.

Conducted in 1988, one of the largest studies of technology use in teacher education programs involved 32 Michigan teacher education programs. Representatives from 32 teacher-preparation institutions, K-12 schools and professional organizations in Michigan established a task force to address the integration of technology into preservice education programs (Novak & Berger, 1991). Michigan's colleges and universities with teacher-certification programs were surveyed to collect information about the state of technology use in

preservice teacher education. Results from the survey indicated that one-third of the faculty had computers in their offices. While sixty-one percent of the faculty reported they used computers for personal or professional tasks, only twenty-one percent actually used computers for instruction with preservice teachers. Seventy-five percent of the institutions reported they integrated computer experiences into teaching methodology and educational foundations courses, but none offered any type of technology-specific field experience for preservice teachers. However, forty percent of the institutions stated that preservice teachers often had the opportunity to use technology in field experiences in the schools.

Collectively, the findings from these studies provide little information indicating the widespread use of computer-related technology in teacher education programs. Little documentation exists evidencing attempts by teacher education faculty to use computer-related technology for the improvement of teaching and learning. However, there is information on general approaches colleges and universities are using to prepare preservice teachers to use computer-related technology.

Approaches used to prepare preservice teachers to use computer-related technology

Two approaches are commonly used by most teacher education institutions to prepare preservice teachers to use computer-related technology. One approach used by many universities is to offer an undergraduate computer-related technology/instructional technology course (Brownell & Brownell, 1994; Cashman & McCraw, 1994). The other commonly used approach typically involves planning for the use and integration of computer-related technology

throughout all teacher education courses (Brownell & Brownell, 1991; Downes, 1992; Harrington, 1991; Niess, 1991; Smith, 1994).

In 1993, approximately 85% of the teacher education institutions in the United States offered at least one computer-related technology/instructional technology course (Johnson & Harlow, 1993). Approximately one half of those institutions reported they required their students to take the course. In the technology-specific course, undergraduate students typically learned how to use and operate technology equipment and software. As a result, most students completed the course with satisfactory knowledge of how to operate the equipment, but few students developed an understanding of how computer-related technology can be integrated into the K-12 curriculum (Callister & Burbules, 1990; Davis, 1993; Deim, 1989). Although used by the majority of teacher preparation institutions, this single course concept is often met with criticism because it frequently promotes technology as a separate curricular topic (Office of Technology Assessment, 1995).

Recently, another approach has emerged at several teacher preparation institutions; this approach attempts to provide experiences for preservice teachers to use computer-related technology throughout all of their courses (Callister & Burbles, 1990; Handler & Marshall, 1992; Harrington, 1991). Throughout their preparation program, it is paramount that preservice teachers participate in educational experiences that model how computer-related technologies can be used for instruction and as learning tools (Bryrum & Cashman, 1993; Niess, 1991). Yet, this approach is not easily implemented due to the lack of training and experience in using these technologies on the part of teacher education faculty (Beaver, 1990; Smith, 1994). To integrate computer-

related technology successfully throughout a teacher preparation program, teacher education faculty must be supported and given time to learn how to use and integrate these technologies into their courses. Although computer-related technology integration throughout teacher education courses is not easily accomplished, there are a few preservice teacher preparation institutions that have created technology integration models aimed at the infusion of computer-related technology throughout their preparation programs.

Computer-related technology integration models used in preservice teacher education programs

Technology has been identified as one of the major goals within the teacher education program at the University of Virginia's Curry School of Education (Mergendoller, 1994; Office of Technology Assessment, 1995). Several key factors that have contributed to the success of the Curry School of Education integration model are the support provided by administration, the development of faculty members' technology expertise, the support faculty provided their colleagues, and the technology enriched field experiences established for preservice teachers in local schools. In this model, technology integration is funded from the Curry School of Education's budget and technology instruction and support is provided for individual faculty members in hopes of developing a critical mass of technology-using faculty.

Lessons learned by the teacher education faculty and students from the Curry School of Education as a result of this technology integration model are noteworthy. Results indicate that a critical mass of faculty who are comfortable using computer-related technology should be established "to encourage the growth of a technology-using culture within the school" (Office of Technology

Assessment, 1995; p. 195). In addition, experiences from the Curry School of Education make it clear that it takes a long time, possibly 3-5 years, to prepare preservice teachers and faculty to use computer-related technology. Finally, when mentoring individual faculty members, it is necessary to begin at their level of expertise and provide training that meets their needs.

Five components comprise the comprehensive technology integration model for faculty development at the University of New England (Kortecamp & Croninger, 1995). The five components of this technology integration model include: 1) familiarizing faculty with hardware and software through workshops, 2) partnering with mentors, 3) developing personal projects, 4) becoming mentors, and 5) keeping current with new knowledge and technological innovations. Although this technology integration model just began in 1994, it has received positive responses from faculty and administrators involved in the program. Faculty have reported that this integration model has supported their efforts to integrate technology into the teaching methodology courses.

Teacher education faculty and administration at Southern Illinois University discussed the issues, problems, and possible solutions for integrating technology at their institution (Nelson, Andri, & Keefe, 1991). Computer-using teacher education faculty were identified early and asked to become part of the plan during the developmental stages. Non computer-using faculty were encouraged to become involved by having their students use word processors and other tools to complete course assignments. All teacher education faculty were asked to set aside eight hours of class time each semester to focus on computer instruction. Equipment was purchased and workshops were conducted to support faculty who were using computer-related technology. No

formal evaluation of this plan has been completed, but both faculty and students have reacted positively to the beginning of this computer-related technology integration model.

At Northwest Missouri State University, teacher education faculty developed a plan for constructing instructional units that focus on technology integration (Fero, 1992). This university's technology integration plan included four phases: 1) a search of the literature to summarize the technology-based educational practices in K-12 schools, 2) a determination of the facilities, hardware, and expertise available on campus, 3) a survey of teacher education faculty to determine what technology was being used by faculty and what technology was being taught in educational methods courses, and 4) selection of a group of interested faculty to help develop a unit of instruction for each of their courses.

In summary, some schools or colleges of education have described technology integration models that promote the use and integration of computer-related technology throughout preservice teacher education programs. The technology integration models described in this section not only focus on training teacher education faculty to use these technologies, but more importantly, provide faculty with the opportunity to plan how these technologies might be infused into their existing courses. There exists little data, however, on the effects of these approaches or the use of computer-related technology by teacher education faculty in general. To plan programs for teacher education faculty, there exists a need to document current levels of computer-related technology use among teacher education institutions.

Methodology

This descriptive research study was designed to assess the use and integration of computer-related technology by preservice teacher education faculty in seven Research I universities: Michigan State University, North Carolina State, Ohio State University, Purdue University, University of Arizona, University of Illinois at Urbana-Champaign, and University of Minnesota. Data gathered from this study described faculty past and current proficiency in using computer-related technology, faculty attitudes toward computer-related technology, and factors that affected faculty use and integration of computer-related technology. In addition to surveying the teacher education faculty from these seven Research I institutions, preservice teacher education faculty from Iowa State University also participated in the study. The results of Iowa State study are reported elsewhere in Schmidt (1995). This summary of the research methodology includes three sections: the research procedure, the development of the instrument, and the description of the respondents.

Research procedure

Seven teacher education institutions were surveyed to gather normative data to help identify national trends in teacher education faculty use and integration of computer-related technology. First, the dean of the Iowa State University College of Education contacted the deans of the Colleges of Education from Iowa State University's Peer 11 institutions. All eleven of these universities are land grant institutions. During this conversation, the dean at Iowa State University inquired about the interest of each dean in having the teacher education faculty from his/her institution participate in the study and

obtained permission to survey the teacher education faculty at the institution. Each College of Education dean was asked to name a faculty member who would serve as a university contact person; this university contact person provided a list of teacher education faculty names and addresses from his/her institution. As a result of these conversations, seven universities participated in the study in addition to the preservice teacher education faculty at Iowa State University. Teacher education faculty from the following universities participated in this study: Michigan State University, North Carolina State University, Ohio State University, Purdue University, University of Arizona, University of Illinois at Urbana-Champaign, and University of Minnesota.

Next, the Chair of the Department of Curriculum and Instruction at Iowa State University contacted a faculty member at each institution by telephone or electronic mail. This contact was made to secure a list of full-time, teacher education faculty members in his/her college who were primarily responsible for teacher preparation at the elementary school level. A list of teacher education faculty names and addresses from each institution were sent to the researcher so surveys could be addressed and mailed directly to each preservice teacher education faculty member.

During April and May of 1995, 292 full-time, preservice teacher education faculty from seven universities were sent the questionnaire along with a cover letter and a postage-paid, return envelope (Appendix A). Each survey was assigned an identification number and personally addressed to the university faculty member. A set of surveys for each institution was sent to the university contact person for distribution. Approximately two weeks after the initial

mailing, a postcard reminder was sent to all non-respondents. One week later, a second copy of the questionnaire was mailed directly to all non-respondents.

Eighty-one faculty members returned the survey after the first mailing. An additional 41 surveys were returned after the postcard reminder and second survey were sent. A total of 122 teacher education faculty responded to the survey. The final response rate was 42%.

Along with the questionnaire, a telephone interview was conducted with a faculty member from each of the seven universities. The faculty member for the interview was selected because he/she was identified as being the one person who had the most expertise about the technology initiatives taking place at each respective university. Additional background information about each university was obtained during the telephone interview. This information provided an overall description regarding the current status of computer-related technology use and integration throughout each university's teacher education program. Topics that were discussed during the telephone interview included the accessibility of computer-related technology throughout the program, the instructional technology courses required and/or offered in the program, and the availability of internal funding sources to support technology integration in the program.

Development of the instrument

The seven page questionnaire, *Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, was developed to gather descriptive information about the current state of computer-related technology use by teacher education faculty. Since there has been considerable

research conducted on K-12 teachers in this area, several questionnaires used for national and state studies on K-12 computer-related technology use and integration were examined (Becker, 1986, 1990; Minnesota Department of Education, 1989; Office of Technology Assessment, 1988; 1995; Schmidt, 1991; Sheingold & Hadley, 1990; Topp, 1993). Common computer-related technology themes were identified in these surveys and used to create the framework for a questionnaire that would survey preservice teacher education faculty. Themes that emerged from previous studies were faculty proficiency in using computer-related technology, faculty attitudes toward computer-related technology, and how faculty integrate computer-related technology into their courses.

The questionnaire was developed by the researcher with assistance from other university faculty members. Faculty assisting in the development of this instrument included the Dean of the College of Education, the chair of the Department of Curriculum and Instruction, a professor in research and evaluation, two professors in the Department of Curriculum and Instruction and a teacher education professor from the University of Nebraska, Omaha. Several meetings were held between the researcher and these university faculty members to discuss the objectives for the study and to develop the survey instrument. Using the suggestions and recommendations offered by these faculty members, an instrument was designed to assess preservice teacher education faculty' proficiency in using computer-related technology, attitudes toward computer-related technology and methods for integrating computer-related technology into courses.

A draft of the survey was pilot-tested with twelve teacher education faculty at a midwestern university. These teacher education faculty members

were asked to complete the questionnaire and to make comments about any items they perceived as unclear. Also, each respondent documented the time required to complete the survey. Final revisions were made to the questionnaire based on comments submitted by these teacher education faculty. Survey revisions included rewording a few of the items, adding one question to the background section, and deleting one item from the integration section of the questionnaire.

The final seven page questionnaire, *Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, contained 82 items that were organized into five sections: (1) background information, (2) current proficiency in using computer-related technology, (3) past proficiency in using computer-related technology, (4) attitudes toward computer-related technology, and (5) integration of computer-related technology into a teacher education program.

Design of section one: Background information

The purpose of section one of the survey was to obtain descriptive background information about the respondents. Items in this section requested information about respondents' gender, age, years of higher education teaching experience, academic rank, and courses taught. Also, respondents were asked to indicate if they had a computer in their office and if so, how many years the computer had been in their office.

Design of sections two and three: Current and past proficiency using computer-related technology

Sections two and three of the survey asked teacher education faculty to rate their current and past proficiency in using various instructional technology

equipment and computer-related technology applications. Portions of the surveys, *Iowa Survey of Computer-Related Technology Use by K-12 Teachers* (Schmidt, 1991) and *Survey of K-12 Computer-Related Technology Use by Iowa State Graduates* (Topp, 1993) were used in the development of items for these two sections of the survey. In both sections, respondents used a Likert scale to answer twenty five items that indicated their current and past proficiency in using these technologies. At the end of section three, an additional three items were included so the respondents could rate their overall personal proficiency, their departmental peers' overall proficiency, and their students' overall proficiency for using computer-related technology.

Design of section four: Attitudes toward computer-related technology

Teacher education faculty attitudes toward computer-related technology were determined in section four. The fifteen items in this section were taken from Schmidt (1991). Respondents were asked to indicate to what extent they agreed or disagreed with each item using the five point scale as described by Henerson, Morris and Fitz-Simmons (1978).

A rotated varimax factor analysis was conducted to measure the unifying concepts that characterized the responses of the fifteen attitude items. Two factors emerged from this analysis. Items included in the first factor related to the general attitude of faculty toward using computer-related technology, and items included in the second factor related to the confidence of faculty in using computer-related technology (Table 1).

A Cronbach alpha reliability coefficient was obtained for each of the attitude factors to test the internal consistency of the attitude items. The general attitude factor had a reliability coefficient of $r = .86$, and the confidence attitude

Table 1. Factor loadings for items in each attitude construct.

Factor and Items	Varimax
<i>Factor 1: General Attitude</i>	
I feel it is important for educators to be able to use computer-related technology.	.82
I would like to improve my skills using computer-related technologies.	.69
Overall, I think the computer is a very important instructional tool.	.68
Computer-related technologies should be used to improve learning throughout the curriculum.	.68
Computers are valuable tools that can be used to improve the quality of education.	.65
Computer-related technologies should be used by faculty more than they are now.	.65
In the future, I will integrate computer-related technology much more for teaching.	.65
Computer-related technologies are of little value for instruction because they are too difficult to use.	.62
I think computers make work more enjoyable.	.54
<i>Factor 2: Confidence</i>	
I lack confidence in using a computer to complete my work.	.78
I do not feel comfortable using computer-related technologies in my teaching.	.75
I do not feel threatened by computers.	.75
I am comfortable using computer-related technologies for my own work.	.72
It has been a struggle for me to learn how to successfully use a computer.	.65
I think computers make my professional work more difficult.	.55

factor had a reliability coefficient of $r = .82$. Both coefficients are within the range (.47-.98) of accepted standard attitude scales (Borg & Gall, 1989).

Design of section five: Integration of computer-related technology into a teacher education program

A review of the research literature on factors that impact the use and integration of computer-related technology provided the basis for the fifth section of the survey (Beaver, 1990; Davis, Willis, Fulton, & Austin, 1995; Davis, 1993; Handler & Marshall, 1992; Office of Technology Assessment, 1995, Strudler, 1991). This section contained seven questions; each question was designed to identify various factors that influenced the integration of computer-related technology into preservice teacher education programs. Two questions in this section asked the respondents to rank a list of items in order of importance. The other five items were open-ended questions that required a written response from each respondent. One of the five open-ended questions provided space for the respondents to write additional comments, suggestions, or concerns. Appendix M contains a complete list of responses to that question.

Two questions in section five gave respondents the opportunity to rank in order of importance a list of items. Using a list of seventeen items, the first question asked respondents to rank the top five reasons why they used or would use computer-related technologies in their courses. The second question gave respondents a list of thirteen barriers and asked them to rank the top five barriers that most impeded their use of computer-related technology. For both of these questions, space was provided for respondents to add their own reasons or barriers.

Four additional open-ended questions were included to address various computer-related integration topics. One open-ended question encouraged each respondent to describe the one factor that helped him/her learn how to integrate computer-related technologies into courses. Another open-ended question required the respondents to describe, in order of importance, how support for using computer-related technology had been made available to them. Also, respondents were asked to suggest additional types of support that would be helpful to them in their attempts to integrate computer-related technology. Finally, respondents were to describe briefly their single most successful use of computer-related technology in teaching.

Description of the sample

Data were collected that described both the respondents and the universities that participated in this study. In the next section, a summary of the information obtained by telephone interviews is presented. This information provides a general overview of the state of computer-related technology use and integration throughout each university's teacher education program. Then, a description of the teacher education faculty who responded to the questionnaire is presented.

Background information about Research I universities

Additional background information was obtained from each of the seven universities by a telephone interview. A faculty member who worked closely with the education college's technology initiatives at each institution was interviewed by the researcher. All seven of the selected Research I universities that participated in this study had teacher preparation programs; two of the

universities have a 5 year teacher preparation program. Student enrollment in the teacher education programs at these universities were from approximately 250 students to 2500 students.

Although the accessibility of computer-related technology in the college of education varied between each university, all did have computer laboratories/classrooms available for faculty and student use. The majority of these computer laboratories/classrooms were not maintained by the college, but were maintained instead by the university. However, most of the computer laboratories/classrooms were staffed by college of education students. The hours that the computer laboratories/classrooms were available for faculty and student use varied slightly between each university; at several of the universities the computer laboratories/classrooms were open approximately 12 hours each weekday while one university's facilities were open 24 hours a day.

Other types of technologies were also available to college of education faculty and students at these seven universities. The majority of the institutions had equipment such as camcorders, videotape recorders, scanners, and CD ROM players available for faculty and student use. All of the universities indicated that the computers in their laboratories/classrooms and faculty offices were networked; however, networking capabilities at two of universities were just made available within the last year.

There was an instructional technology/media course available for students to take at each of the seven universities that participated in this study. However, the course was required for students who attended three of the institutions, and was not a required course at three. At the other university, students had to complete six technology literacy modules during their

preparation program to fulfill a state technology requirement. Students attending this university did not complete the technology modules in one course, but finished the modules at various times in different courses throughout their preparation program.

Description of the respondents

Two hundred ninety-two surveys were mailed to teacher education faculty at the following seven Research I universities: Michigan State University, North Carolina State University, Ohio State University, Purdue University, University of Arizona, University of Illinois at Urbana-Champaign, and University of Minnesota. A total of 122 teacher education faculty responded to the survey for a final response rate of 42%.

The demographic information about the respondents from these seven universities showed that 51.6% were male and 48.8% were female. Almost one-third of the respondents (30.3%) were between the ages of 50-59 years, and slightly less than forty percent (38.5%) were between 40-49 years. Eighteen percent (18%) of the respondents were between the ages of 30-39 years, while thirteen percent (13.1%) were over 60 years of age. None of the respondents were under the age of 30. Only one respondent out of the 122 faculty members who responded to the questionnaire indicated that he/she did not have an office computer.

Respondents were asked to indicate their years of teaching experience in higher education and their academic rank. One third of the respondents (34.4%) had twenty years or more of teaching experience in higher education (Figure 1). Slightly over twenty percent (20.5%) of the respondents had between 6 and 10 years of teaching experience and slightly less than twenty percent (19.7%) had less than five years of higher education teaching experience. Thirteen percent

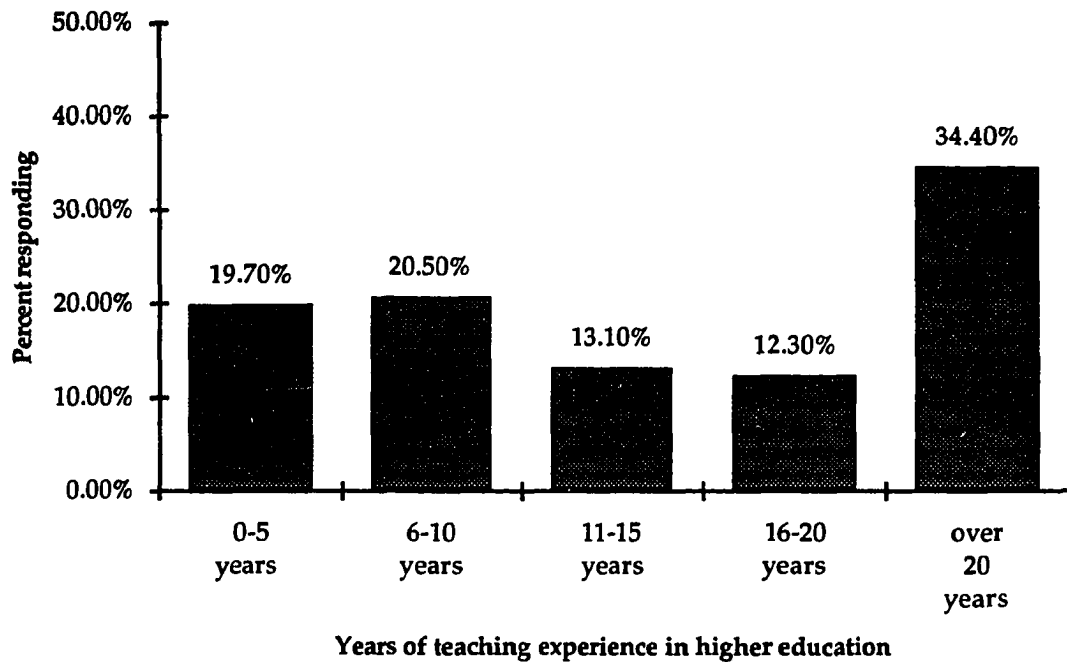


Figure 1. Respondents' years of teaching experience in higher education

(13.1%) and twelve percent (12.3%) of the respondents had between 16 and 20 years and 11 and 15 years of teaching experience respectively. In regard to academic rank, thirty-three percent (33.6%) and thirty-two percent (32.8%) of the faculty who responded were full professors and associate professors respectively (Figure 2). Slightly over one fourth of the respondents (26.2%) were assistant professors and five percent (5.7%) were instructors. One percent of the respondents (1.6%) indicated they held some other academic rank.

The respondents were asked to report the type of teacher education courses they taught. Over one-half of the respondents (54%) taught an undergraduate teaching methodology course. Thirty-six percent of the respondents (36.1%)

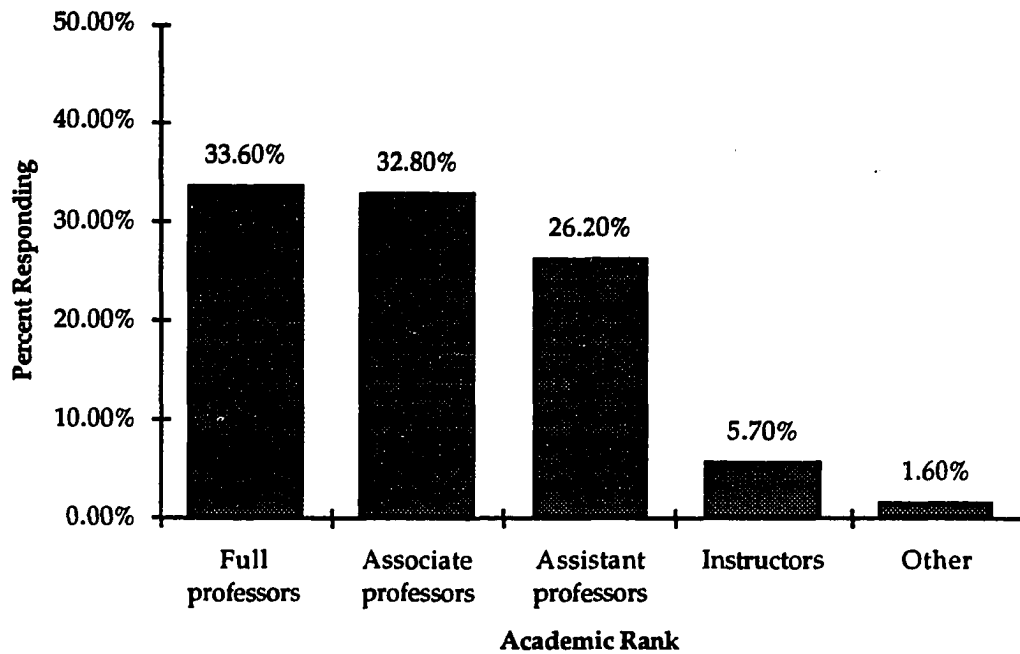


Figure 2. Academic rank of respondents from seven Research I universities

supervised field experiences for teacher education students, while subject-specific courses were taught by thirty-one percent of the respondents (31.1%). Fifteen percent of the respondents (15.6%) were teaching undergraduate educational foundation courses and less than ten percent (9.8%) were teaching instructional technology courses. Only three percent of the respondents (3.3%) indicated they taught a special education course. The majority of respondents (85.2%) taught graduate level courses.

Results

Faculty responses from the questionnaire, *A Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty*, were used to compute descriptive information about: (1) faculty current and past proficiency using computer-related technology, (2) faculty attitudes toward computer-related technology, and (3) factors that affect the faculty use and integration of computer-related technology. Results from the entire survey are be reported in the sections that follow.

Current and past proficiency in using computer-related technology by preservice teacher education faculty

The purpose of the second and third sections of the questionnaire was to assess the current and past proficiency in using computer-related technology by preservice teacher education faculty. Participants were asked to respond to items that addressed their current and past proficiency for using instructional technology equipment and computer-related technology applications. Past proficiency was defined as proficiency in using computer-related technology five years ago or during the 1989-1990 academic year. The following Likert scale was used to measure faculty proficiency: 1 = No proficiency; 2 = Little proficiency; 3 = Moderate proficiency; and 4 = High proficiency.

Current and past proficiency in using instructional technology equipment

This section reports the respondents' perceptions of their current and past proficiency in using instructional technology equipment. First, participants' mean responses for their current proficiency in using instructional technology equipment will be summarized. Respondents' perceptions of past proficiency in

using instructional technology equipment will be used for dependent t-test procedures comparing current and past mean responses.

Preservice teacher education faculty from the seven Research I universities were asked to rate their current personal proficiency in using ten different types of instructional technology equipment listed on the questionnaire (Figure 3). The respondents rated their overall general use of the computer as 3.40. This average mean response indicated they rated their current personal proficiency in using a computer between moderate and high. The next two highest responses for individual items in this section were for using a camcorder (2.84) and a modem (2.82), indicating that these respondents have close to moderate proficiency using this equipment. Other responses for individual items in this section indicated that the respondents have close to little proficiency using a CD ROM (2.19), liquid crystal display unit (LCD) (1.93), still video camera (1.91), and laser disk player (1.91).

Dependent t-test results indicated significant differences between the teacher education faculty current and past proficiency in using all of the instructional technology equipment listed on the questionnaire (Tables 7-15). Respondents showed the most improvement for using a CD ROM and a modem. Mean responses for these two items indicated that faculty went from having little to moderate proficiency using a modem and from having no to little proficiency using a CD ROM. Although faculty proficiency improved using all of the instructional technology equipment listed, respondents still report between little and no proficiency using several of the newer instructional technology equipment such as a still video camera, a distance education system, a scanner, and a LCD panel.

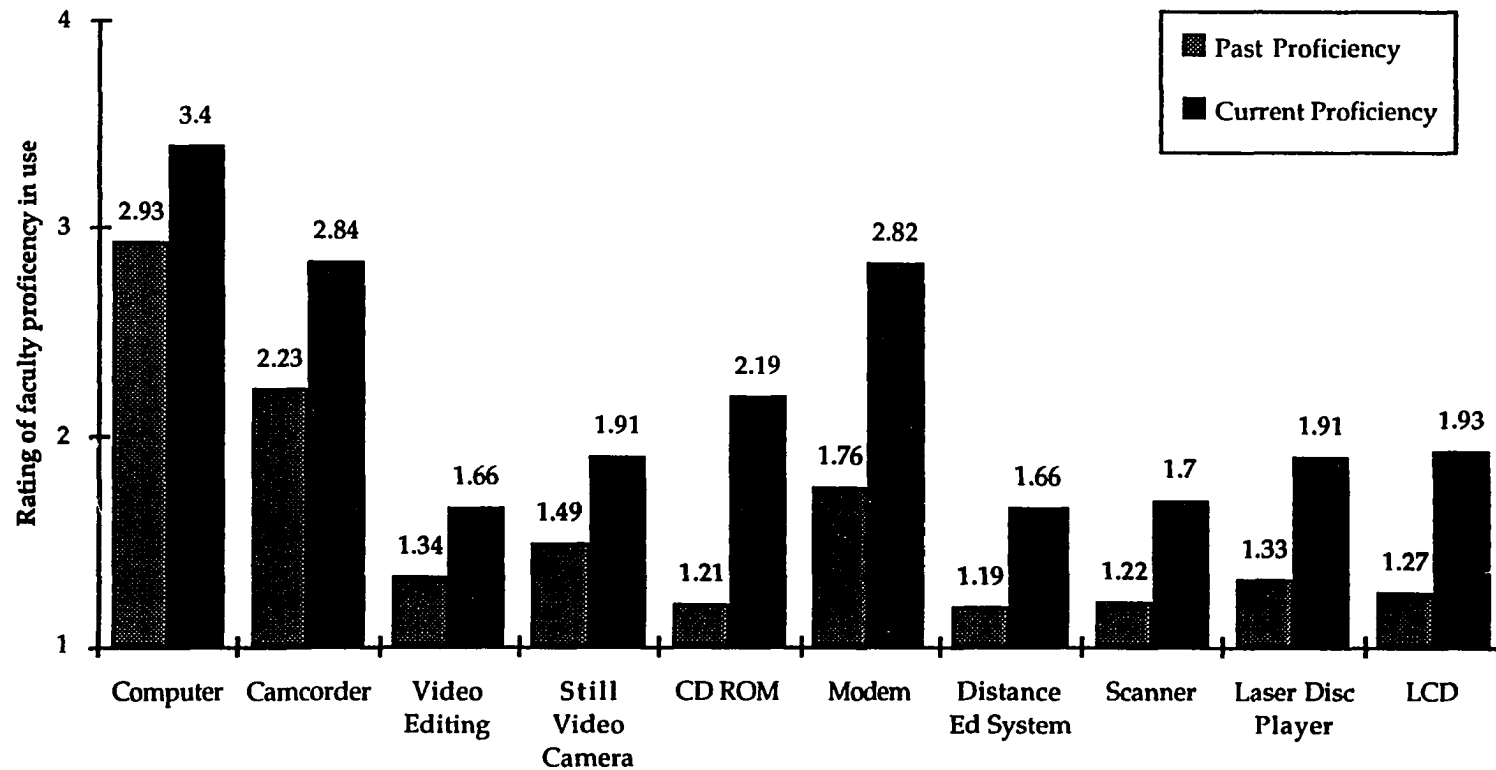


Figure 3. Mean responses of respondents from seven Research I universities for proficiency in using instructional technology equipment

Current and past proficiency in using computer applications

In this section, results of respondents' perceptions of their current and past proficiency in using computer applications are described. A summary of the mean responses for current proficiency in using computer applications is reported. Then, the results from the dependent t-test procedures between current and past proficiency means are presented.

Preservice teacher education faculty were asked to indicate their current proficiency in using fifteen computer applications. Word processing had the highest mean response with 3.63; this mean response is closer to high than moderate proficiency (Figure 4). Over ninety-six percent (96.7%) of the respondents rated their proficiency for using word processing either moderate or high, while only three percent (3.3%) indicated they had little proficiency using this tool. The two next highest mean responses were for using Internet or Bitnet (2.92) and for using Local Area Network Communication (2.61); both mean responses indicated between moderate and high proficiency using these technology applications.

Respondents indicated close to moderate proficiency in using a number of other computer tool applications listed on the questionnaire. The current proficiency mean responses were lower for these computer applications than the mean response reported for word processing. The mean response for databases was 2.28, spreadsheets was 2.26, statistic programs was 2.2, drawing programs was 2.06, desktop publishing programs was 2.04 and presentation programs was 1.91. All of these mean responses indicated that the respondents had currently close to little proficiency using these applications. Respondents reported between little or

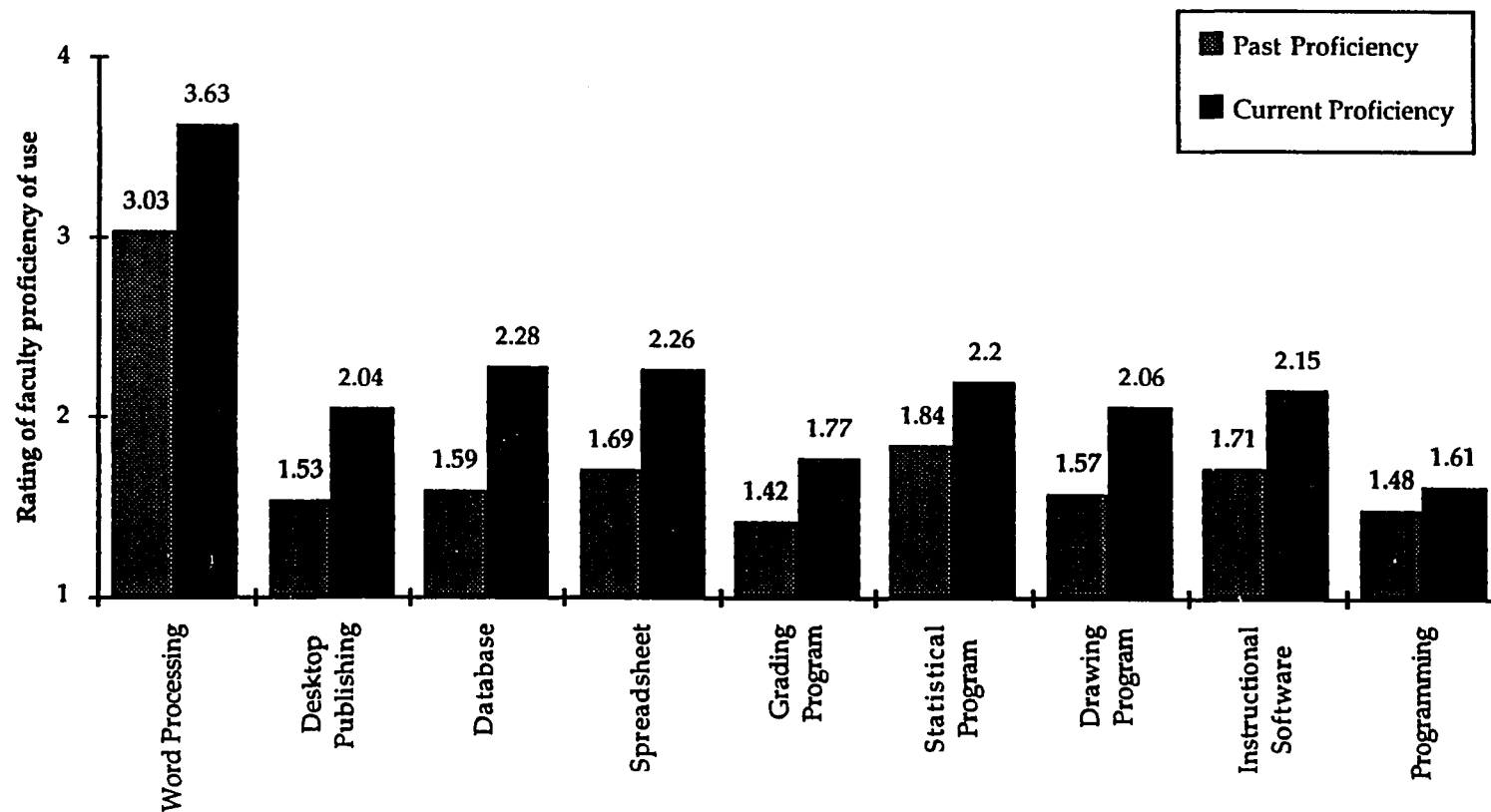


Figure 4. Mean responses of respondents from seven Research I universities for proficiency in using computer-related technology applications

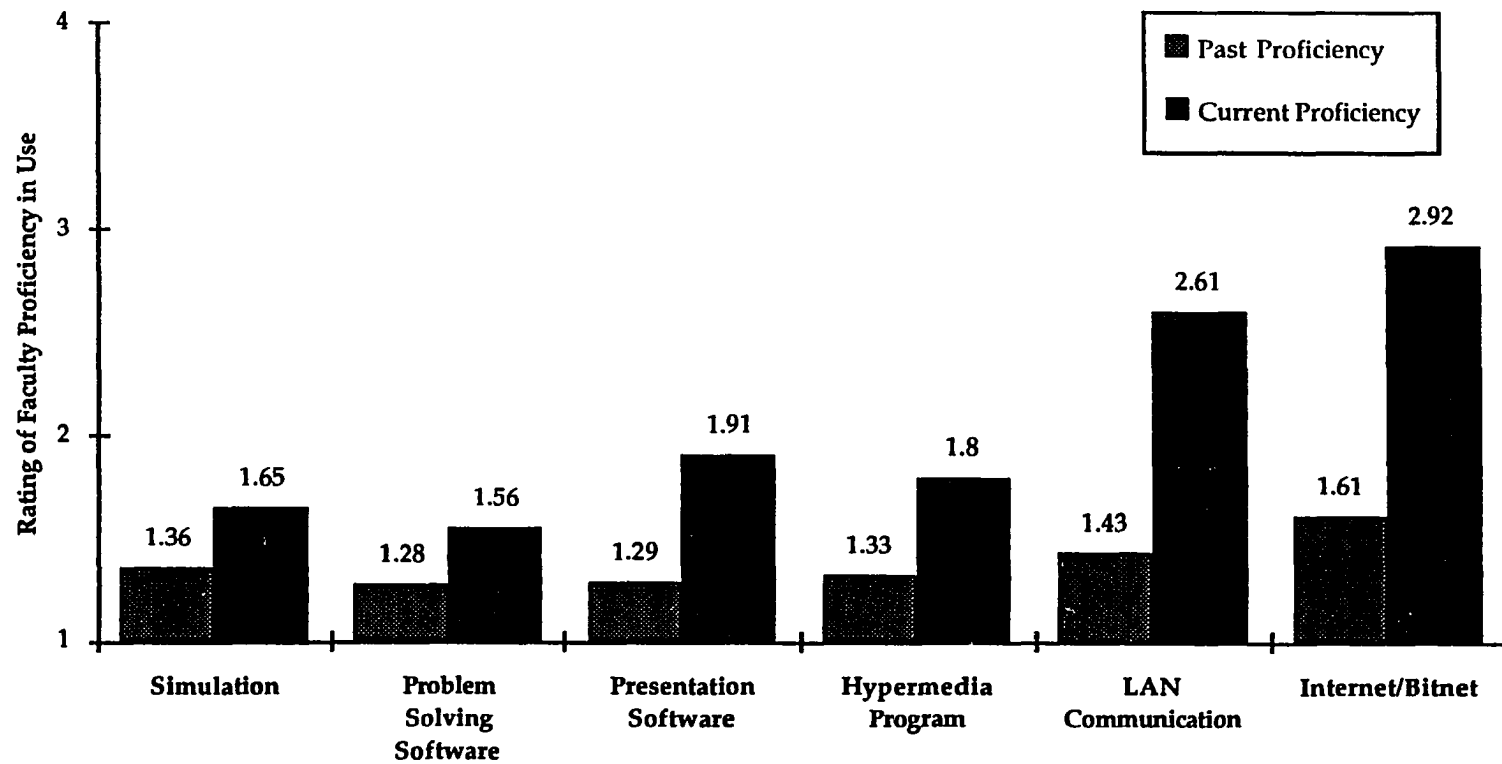


Figure 4. (continued)

no proficiency in using hypermedia programs (1.80), grading programs (1.77), simulations (1.65), and programming (1.61).

Dependent t-test results on the differences between preservice teacher education faculty current and past proficiency means in using all of the computer applications listed on the questionnaire were significant (Tables 16-30).

Respondents' proficiency for using LAN communication and the Internet showed the most improvement between past and current proficiency means. Respondents improved from having close to no proficiency using these communication technologies five years ago, to currently having close to moderate proficiency. Respondents reported they still had little proficiency using desktop publishing programs, databases, spreadsheets, statistical programs, drawing programs and instructional software programs.

Overall proficiency using computer-related technologies of self, departmental peers and students

After rating their current and past proficiency in using a variety of computer-related technologies, the respondents were asked to rate their current overall personal proficiency in using computer-related technologies. In addition to rating their overall personal proficiency, respondents were asked to rate their departmental peers' and students' current proficiency using computer-related technologies. The likert-type scale provided the following choices: 1) Very inadequate, 2) Inadequate, 3) Adequate, 4) More than Adequate, and 5) Outstanding.

Teacher education faculty rated both their overall personal proficiency (2.98) and their peers' proficiency (2.94) as close to adequate. It also should be noted that almost thirty percent (28.7%) of the respondents rated their overall

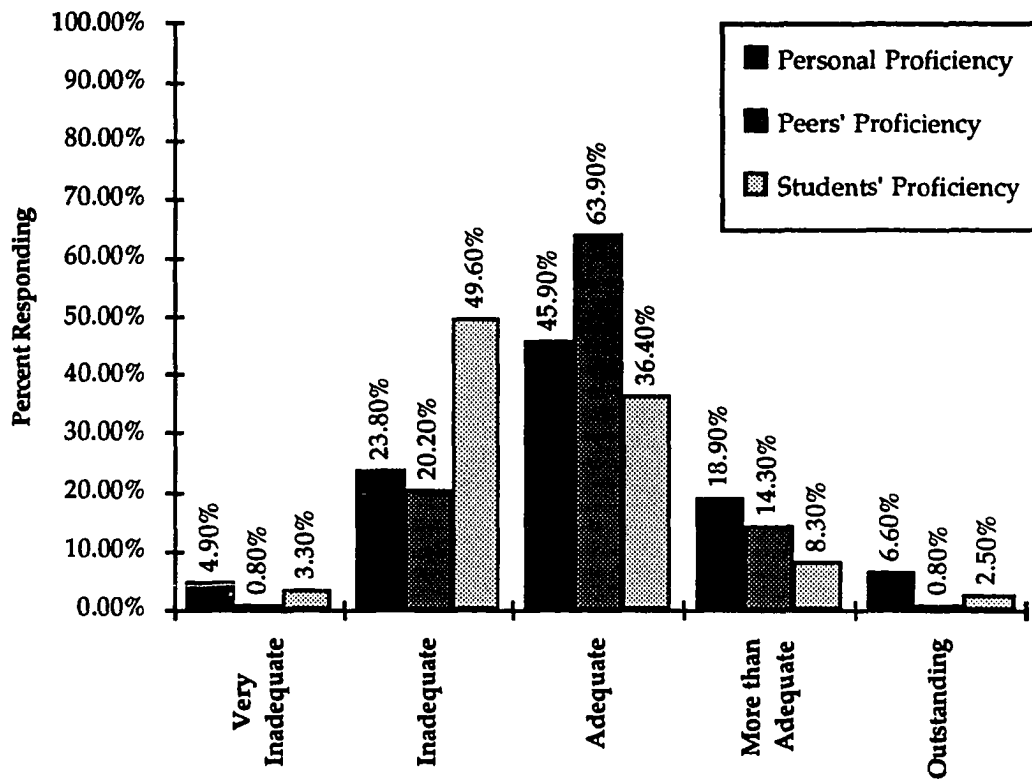


Figure 5. Respondents' ratings of their overall personal proficiency, their departmental peers overall personal proficiency, and their students' overall personal proficiency in using computer-related technology

personal proficiency as inadequate or very inadequate (Figure 5). Sixty-four percent (63.9%) of the respondents rated their departmental peers' personal proficiency as adequate. Respondents' mean response for their students' proficiency in using computer-related technologies was 2.57, indicating their students' proficiency was between inadequate and adequate. However, over fifty percent (52.9%) of the respondents indicated that their students' proficiency was either inadequate or very inadequate.

Preservice teacher education faculty attitudes toward computer-related technology

Section four of the survey assessed preservice teacher education faculty attitudes toward computer-related technology. There were fifteen items on the survey that measured faculty attitudes toward computer-related technology. The Likert scale for these items was as follows: 1 = Strongly Disagree; 2 = Disagree; 3 = Undecided; 4 = Agree; 5 = Strongly Agree. Five attitude items that were negatively worded were reversed scored (i.e., 1=5, 2=4, 4=2, 5=1) for analysis purposes.

After a rotated varimax factor analysis was conducted, two attitude factors emerged from the fifteen attitude items on the survey. The two attitude factors that emerged were a general attitude toward computer-related technology factor and a confidence toward using computer-related technology factor.

The mean responses reported by the preservice teacher education faculty from these seven universities were positive. The general attitude factor had an average mean response of 4.22; that mean indicated a response closer to agree. Two specific items for the general attitude factor with the highest individual mean score were "Computers are valuable tools that can be used to improve the quality of education" (4.49) and "I feel it is important for educators to be able to use computer-related technology" (4.34). The lowest mean response for an individual item in this factor was 3.85 for "In the future, I will integrate computer-related technology much more for teaching."

The mean response score for the factor, teacher education faculty confidence toward using computer-related technologies, was 4.02. This mean indicated a score close to agree. The highest mean for a specific item in the confidence attitude factor was 4.22; this mean response was shared by the items "I

think computers will make my professional work easier" and "I do not feel threatened by computers." The two lowest-rated individual items for this factor were "It has not been a struggle for me to learn how to successfully use a computer" (3.74) and "I feel comfortable using computer-related technologies in my teaching" (3.88). Still, these means indicated a score closer to agree than undecided.

Integration of computer-related technology throughout a preservice teacher education program

The last section of the questionnaire emphasized the integration of computer-related technology throughout a preservice teacher education program. There were seven questions in this section that addressed computer-related technology integration issues. Respondents were asked to rank the top five reasons why they used or would use computer-related technology in their courses and to rank the top five barriers that impeded their use of computer-related technology in courses. Also, faculty were asked to identify what helped them learn how to integrate technology into their courses, what support was provided for them to use technology, and what additional support should be provided for them to use technology. Finally, respondents described their most successful use of computer-related technology in teaching.

One factor that helped preservice teacher education faculty learn how to integrate computer-related technology

Respondents were asked to describe one factor that helped them learn how to integrate computer-related technologies into their courses. This was an open-ended question on the survey designed to encourage respondents' own

responses. Fifty-eight percent of all teacher education faculty who completed the survey responded to this question.

After reading through the respondents' open-ended responses to this question, the researcher classified these responses into several categories that described the factors that helped faculty integrate computer-related technology into their courses (Table 2). Also, two professors from Iowa State University were asked to classify these responses according to the categories suggested by the researcher. The two professors' classifications were compared to the researcher's and a final list of responses was compiled for each category. A list of all the respondents' open-ended responses classified by category appear in Appendix I.

Over half of the preservice teacher education faculty who responded to this questionnaire listed a factor that helped them learn how to integrate computer-related technology into their courses. Respondents listed the following two factors most frequently: "Learned about technology by personal exploration" and "Received assistance from faculty member(s)." Although assistance from graduate and undergraduate students was listed by a few respondents, it appeared most faculty sought technology integration assistance from their faculty peers. Six of the respondents cited various communication technologies as factors that helped them with technology integration; their responses mentioned that these technologies made it easier to communicate with students and colleagues. Easy access to hardware and software and time were cited by only a few of the respondents.

Table 2. Faculty responses from seven Research I universities indicating what one factor helped them learn how to integrate computer-related technology into their courses

Categories of faculty responses	Number of responses for each item
Learned about technology by personal exploration	15
Received assistance from faculty member(s)	15
Used communication technologies (e.g., email) to communicate with students and colleagues	6
Identified the need to integrate to support teaching and learning	6
Received support from someone else	5
Provided easy access to hardware and software	4
Received assistance from graduate student(s)	3
Learned from undergraduate students	3
Time to learn	2
Other	5

Reasons why preservice teacher education faculty used or would use computer-related technology in the courses they teach

Preservice teacher education faculty were asked to rank the top five reasons why they used or would use computer-related technology in the courses they taught. Seventeen reasons for using computer-related technology were listed on the survey. Space was provided so respondents could write their own responses if needed. Respondents ranked the top five reasons by placing a 1 beside the most important reason for using computer-related technology, a 2 beside the next most important reason, and so on up to 5. Before the data were analyzed, the ranked items were reversed scored (i.e., 1=5, 2=4, 4=2, 5=1). Then, all the scores were summed for each item. For example, the item with the largest sum was identified as the most important reason for using computer-related technology.

Preservice teacher education faculty from these seven universities were asked to rank the seventeen reasons for using computer-related technology in courses (Table 3). The highest ranked item by teacher education faculty was "helps prepare students to teach in future school settings." One-third (33.1%) of the respondents ranked this item either number one or two, but almost as many respondents (32.2%) didn't rank the item in their top five. Using computer-related technologies for student learning was viewed as important because three of the top six most important reasons ranked by respondents mentioned the topic: "enhances student learning," "encourages active student learning," and "assists student learning." The fourth item, "enables learning experiences otherwise impossible," was ranked by over fifty percent (51.2%) of the respondents. External factors that might have been considered as reasons for using computer-related technology were ranked low by respondents. "Supports university mission," "addresses expectations of administration," and "addresses the demands of the university reward structure" were three of the lower ranked reasons for using computer-related technology by respondents.

Barriers preservice teacher education faculty encountered using or trying to use computer-related technology in the courses they teach

Next, respondents were asked to rank the top five barriers they encountered while using or trying to use computer-related technology in the courses they taught. Thirteen barriers were listed on the survey and space was provided for the respondents' own responses. Ranking an item number one meant that barrier most impeded their use of computer-related technology (Table 4).

Table 3. Faculty responses from seven Research I universities indicating the reasons for using computer-related technology in courses

Ranking	Reasons for using computer-related technology	Number of respondents	Minimum	Maximum	Sum
1	Helps prepare students to teach in future school settings	82	0	5	267
2	Enhances student learning	72	0	5	235
3	Encourages active student learning	61	0	5	212
4	Enables learning experiences otherwise impossible	62	0	5	207
5	Models effective uses of technology for teaching and learning	68	0	5	198
6	Assists student learning	51	0	5	128
7	Facilitates individualized instruction	39	0	5	121
8	Encourages me to try new things in my teaching	45	0	5	108
9	Addresses multiple student learning styles	31	0	5	88

Table 3. (continued)

Ranking	Reasons for using computer-related technology	Number of respondents	Minimum	Maximum	Sum
10	Addresses expectations of K-12 school administration and teachers	18	0	5	49
11	Other	13	0	5	43
12	Addresses personal satisfaction	8	0	5	16
12	Addresses expectations of college students	6	0	5	16
14	Addresses a departmental goal	4	0	5	13
15	Supports university mission	4	0	3	9
16	Addresses the expectations of departmental peers	3	0	4	8
17	Addresses expectations of administration	3	0	4	7
18	Addresses the demands of the university reward structure	1	0	4	4

Table 4. Faculty responses from seven Research I universities indicating the barriers they encountered in using computer-related technologies

Ranking	Barriers encountered in using computer-related technology	Number of respondents	Minimum	Maximum	Sum
1	Lack of time to learn new technologies	93	0	5	368
2	Lack of available equipment	82	0	5	289
3	Lack of training to use new technologies	75	0	5	252
4	Lack of technical support for using technology	64	0	5	158
5	Lack of software for the courses you teach	52	0	5	148
6	Not enough class time, too many topics	46	0	5	124
7	Lack of personal comfort with using technology	22	0	5	67
8	Not applicable to the course subject matter	21	0	5	64
9	Students are not prepared to use technologies	16	0	5	46
10	Other	14	0	5	39
11	Lack of administrative support for using technology	16	0	5	34
12	Technology does not enhance student learning	4	0	5	18
12	Students do not feel technology is important for learning course content	8	0	5	18
14	K-12 schools do not expect teachers to use technologies	0	0	0	0

The barrier ranked highest by respondents was "lack of time to learn new technologies." Fifty-six percent (56.2%) of the respondents ranked this barrier either as their first or second choice. The lack of equipment, lack of training and lack of technical support were ranked 2nd, 3rd and 4th respectively. Barriers that were ranked lowest by respondents included: Lack of administrative support for using technology, Technology does not enhance student learning, and K-12 schools do not expect teachers to use technologies.

Support available to preservice teacher education faculty for using computer-related technology

Respondents identified various ways that support for integrating computer-related technology in teaching had been provided for them at their institutions. Faculty were requested to list their responses in order of importance to them on the survey. All responses were classified by the researcher and placed in categories that described how support was provided for faculty. Again, the same two professors from Iowa State classified the responses as well. Because these responses were listed in order of importance by each respondent, each response was assigned a weighted score for analysis purposes. For example, if an item was listed first by a respondent it was assigned a value of 5, if it was listed second it was assigned a value of 3, and if it was listed third it was assigned a value of 1. The total score for each means of support item was calculated by multiplying the number of total responses for each support item by the weighted score and then adding all of the weighted scores for each category. An entire list of the responses for this question are found in Appendix J.

Clearly, providing easy access to hardware and software was the most important means of support identified by preservice teacher education faculty

Table 5. Teacher education faculty responses indicating what support was available for them to integrate computer-related technology in teaching.

Categories of faculty responses	Number of responses for each item by level of importance			Weighted Totals
	1	2	3	
Easy access to hardware and software	16	6	3	101
Technical support provided within the college	11	7	3	79
Workshops/seminars provided within the college	13	3	2	76
Support from faculty member(s)	12	4	2	74
Financial support for technology hardware and software purchases	6	6	1	49
Hardware/software purchases through grants or outside funding	5	1	1	29
No support provided	4	0	0	20
Workshops/seminars provided outside of the college	2	3	0	19
Technical support provided outside of the college	2	3	0	19
Support from graduate student(s)	2	2	1	17
Other	2	1	4	17
Support from staff	0	3	0	9
Support from department administration	0	0	2	2

from these seven universities (Table 5). Technical support, support from colleagues, and workshops were frequently listed by respondents as being important to support their use of computer-related technology in teaching. Also, the financial support provided for hardware and software purchases supported faculty use. Although respondents indicated that support provided by other faculty members was available, support from graduate students and staff was less evident.

Additional support requested by preservice teacher education faculty for integrating computer-related technology into teaching

After listing the types of support that were available to them, respondents were then asked to suggest additional types of support that would be most useful to them for integrating computer-related technology in teaching. In order of importance, faculty listed three additional types of support. Again, the researcher and the other two professors classified each response into a category that described the means of support requested by each respondent. These responses were assigned a weighted score according to the order of importance placed on that item by each respondent. Appendix K lists the open-ended responses for this question given by the preservice teacher education faculty.

Clearly, "Providing additional workshops/seminars within the college," was cited by respondents most often (Table 6). Providing easier access, providing time, and providing one on one support were frequently mentioned by several of the respondents. Other suggestions such as providing opportunities to watch others using technology in their courses and organizing small mentoring groups for interested faculty were mentioned less frequently by respondents.

Most successful use of computer-related technology in teaching as described by teacher education faculty

Finally, each respondent had the opportunity to describe his/her most successful use of computer-related technology in teaching. In order to classify these responses, the three levels of technology use in teacher education that were identified by the Office of Technology Assessment (1995) were used. In the report, *Teachers & Technology: Making the Connection*, the three levels of technology use were described as follows: 1) discussion/demonstration, 2) technology practice, and 3) professional practice.

Table 6. Faculty responses from seven Research I universities indicating what type of additional support would be most useful to them

Categories of faculty responses	Number of responses for each item by level of importance			Weighted Totals
	1	2	3	
Provide additional workshops/seminars within the college	15	8	2	101
Provide easier access to hardware and software	10	4	3	65
Provide more time	9	3	1	55
Provide person to help and support individual faculty	8	3	1	50
Provide financial support to purchase more hardware and software	6	3	2	41
Purchase more hardware and/or upgrade hardware in place	6	1	3	36
Other	6	1	1	34
Provide technical support within college	3	2	6	27
Provide opportunities to watch others model technology use in the classroom	2	2	0	16
Organize small mentoring groups for interested faculty	3	0	0	15
Provide financial support for development of technology skills integration	1	2	1	12
Provide technology support outside of college	2	0	0	10
Need for students with more expertise	1	0	1	6
Provide additional class time	1	0	1	6
Provide more hardware for students	0	2	0	6
Increase access of technology in K-12 schools	0	1	1	4

Half of all the teacher education faculty (50%) who completed the survey responded to this question. There were a total of 67 faculty responses, so some respondents listed more than one use of computer-related technology in teaching. An entire list of the written responses given by the teacher education faculty can be found in Appendix L.

Slightly over one-half (51%) of the faculty responses were classified as level two use or technology practice. At this level, preservice teachers receive hands-on experience and practice while learning how to use the technology.

Examples of faculty responses for this level of technology use included "Internet-based course to help students learn about using Internet/resources for instruction" and "All of my students use computers for word processing and some of them for email."

Almost one-third (30%) of the faculty responses were identified as level one technology use. This level is referred to as the discussion/demonstration level because it is the professor who demonstrated or discussed how technology can be used in K-12 classrooms. The response, "Use the computer as an electronic slideshow with software such as Powerpoint and Harvard Graphics. This adds color, clip art, and sound to lectures," is a response given by one respondent that demonstrated level one technology use.

Less than twenty percent (19%) of the faculty responses were classified as level three technology use. This level of technology use involves either preservice teachers observing K-12 teachers using technology or themselves practicing teaching with technology. One faculty member's response, "I have students teach a reflective lesson using a computer/software program as lesson content," illustrates a level three use of technology in teacher education.

Summary of the Results

The purpose of this study was to assess the current state of computer-related technology use and integration by preservice teacher education faculty from selected Research I universities. Data were collected from 122 faculty members that described their responses to the following computer-related technology areas: (1) the current and past proficiency of faculty in using computer-related technology, (2) the attitudes faculty have toward computer-

related technology, and (3) the integration of computer-related technology into a teacher education program.

Teacher education faculty were asked to rate their current and past proficiency using instructional technology equipment and computer-related technology applications using the following likert scale: 1 = No proficiency, 2 = Little proficiency, 3 = Moderate proficiency, 4 = High proficiency. The highest rated items for current proficiency in using instructional technology equipment were for the computer (3.4), camcorder (2.84), and modem (2.82). Respondents indicated that they had close to moderate current proficiency using equipment such as a CD ROM (2.19), LCD (1.93), laser disc player (1.91), and still video camera (1.91). Significant differences between faculty current and past proficiency means were reported for all the instructional technology equipment.

Respondents reported having close to high current proficiency using word processors (3.63). Teacher education faculty reported close to moderate proficiency using LAN communication applications (2.61) and the Internet/Bitnet (2.92). Respondents reported having little current proficiency using databases (2.28), spreadsheets (2.26), statistical programs (2.2), and presentation software (1.91). Again, significant differences between teacher education faculty current and past proficiency means in using all of the computer applications listed on the survey were reported.

Teacher education faculty rated their current overall personal proficiency and their peers' overall personal proficiency in using computer-related technology close to adequate. Respondents rated their students' current overall personal proficiency between inadequate and adequate.

Respondents reported their general attitude and confidence toward computer-related technology using the following Likert scale: 1 = Strongly disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, and 5 = Strongly agree. Two attitude factors emerged from the fifteen attitude items using a rotated varimax factor analysis. The average mean response reported for the general attitude factor (4.22) was close to agree. The confidence attitude factor (4.02) had an average mean response that was also close to agree. Overall, the mean responses for these two factors indicated teacher education faculty who responded to the survey had positive attitudes toward computer-related technology.

The integration of computer-related technology throughout a preservice teacher education program was examined in the last section of the survey. The majority of teacher education faculty indicated they had learned how to integrate computer-related technology into their courses by exploring on their own and by receiving assistance from other faculty. Teacher education faculty encountered barriers such as lack of time, lack of equipment, lack of training and lack of technical support in attempting to use computer-related technology. Easy access to hardware and software, technical support, and workshops were mentioned most frequently by respondents as means of support for using computer-related technology provided at their institutions. Respondents indicated they still required additional support such as providing more workshops, providing easier access to hardware and software, providing more time to learn about computer-related technology and providing one-on-one assistance to individual faculty members. Half of all the respondents described their most successful use of computer-related technology in teaching. The majority of these descriptions (51%) indicated that faculty were giving preservice teachers hands-on experience

and practice using computer-related technologies in courses. Fewer faculty (30%) were using computer-related technology for discussion or demonstration in their courses. Less than twenty percent of these descriptions involved either preservice teachers observing K-12 teachers using technology or teaching with the technology themselves.

Conclusions and Recommendations

Results from this descriptive research study indicate that some progress is being made to use and integrate computer-related technology in preservice teacher education programs by teacher education faculty. These findings have identified some critical areas that will need attention if preservice teacher education faculty continue to improve their use and integrate computer-related technology for teaching and learning. Several conclusions can be drawn from these results to assess the current state of computer-related technology use in preservice teacher education programs and to address areas that will need attention to assist teacher education faculty in their use and integration of these technologies in the future.

In recent years, computer-related technology has become more accessible to preservice teacher education faculty and students from these universities. Findings indicated that all but one of the respondents have a networked computer in their office. As of 1988, Novak and Berger (1991) had reported that only one-third of teacher education faculty in Michigan's colleges and universities had computers in their offices. Data collected from the telephone interviews conducted with individual university faculty members at each institution indicated that all of these universities had computer labs or

classrooms available for faculty and student use and had computers and/or projection devices available for faculty to use in classrooms. Clearly, one finding reported that faculty recognized accessibility as their number one means of support available to assist them in using and integrating computer-related technology. However, respondents indicated they still require some additional support to provide even easier and greater access to equipment. As more teacher education faculty begin to use and integrate computer-related technology, the need to have easier and greater access to these technologies will increase (Becker, 1994).

Teacher education faculty are improving their proficiency in using a variety of instructional technology equipment and computer-related technology applications. These respondents perceived they were most proficient using word processors and distance communication applications (i.e., Internet/Bitnet, LAN communication). Much of this improvement by respondents may be the result of their own personal exploration using the technologies. Several of the respondents reported they had spent time teaching themselves about computer-related technology. It is important to note here that K-12 schools studies have reported that most teachers who use computers in their classrooms were self-taught (Becker, 1994; West, 1990).

Overall, teacher education faculty have a positive attitude toward computer-related technology. The respondents agree that the computer is an important instructional tool, that it is important for educators to be able to use technology and that computer-related technologies should be used to improve learning throughout the curriculum. Also, respondents indicated they were confident in their abilities to use computer-related technologies. Since these

respondents have positive attitudes toward using computer-related technology and are reasonably confident in their ability to use these technologies, it will be important to support these positive attitudes by keeping faculty interested and motivated to use these technologies in their courses.

Although it seems teacher education faculty have made some progress in using and integrating computer-related technology, several areas of concern will be highlighted and discussed. Even though teacher education faculty have in general become more proficient in using various computer-related technology application, many of the respondents still have little or no proficiency using most computer applications. Additional support will be required to help teacher education faculty learn how to use and integrate analytical tools such as databases and spreadsheets, as well as emerging technologies such as interactive multimedia. These respondents suggested that providing workshops, technical support and one-on-one mentoring would support them in their attempts to use and integrate computer-related technology.

Although this group of teacher education faculty have generally positive attitudes toward using and integrating computer-related technology, it seems respondents aren't quite as confident individually about using computer-related technology. Average mean responses for a couple of individual attitude items indicates a "We can, but I can't" paradox (Chen, 1986). For example, when computer-related technology use and integration is viewed as something that can be accomplished as a group, the respondents feel more capable; when it is viewed as something to accomplish personally they feel less competent. Two items and their average mean responses that illustrate this paradox are "Computer-related technologies should be used by faculty more than they are

now" (4.22) and "In the future, I will integrate technology much more for teaching" (3.85).

Major barriers identified by teacher education faculty from these seven Research I universities are similar to those often cited by K-12 educators (Office of Technology Assessment, 1995). Time is reportedly the number one barrier most teachers face while attempting to infuse technology into the classroom (Becker, 1990; Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). The majority of respondents from this study reported that time was the greatest barrier they encountered while trying to use computer-related technology. Faculty need time to experiment with the technology and to design classroom applications that integrate computer-related technology. Ways to provide time for teacher education faculty who are interested in using computer-related technology must be addressed. While planning for methods to support faculty attempting to use and integrate computer-related technology, barriers such as time, lack of equipment, and lack of technical support must be minimized.

Because the technology integration process takes time, an environment that is supported by administration and faculty is necessary where teacher education faculty are encouraged and expected to use computer-related technology in their teaching (Mergendoller, 1994). Although creative and flexible solutions are needed to provide more time for teacher education faculty to use computer-related technology, it is important for faculty and administration to realize that the process of technology integration will take time. Even the most highly motivated educators often require three to five years before they feel comfortable enough integrating technology into their teaching practices (Mergendoller, 1994; Office of Technology Assessment, 1995; Sheingold

& Hadley, 1990). First, teacher education faculty must identify a need for using and integrating these technologies in their courses, then it may take several years for them to become both proficient in using computer-related technology and integrating the technology into their teaching.

Computer-related technology use and integration is difficult (Office of Technology Assessment, 1995) and teacher education faculty and administration will need patience to proceed with efforts in this area. Faculty descriptions of their most successful use of computer-related technology in teaching illustrates the variety of ways teacher education faculty are already using and integrating these technologies. However, these data also indicate that faculty must focus on using the technology not only for discussion and demonstration purposes, but to move toward a third level of use which provides preservice teachers with experiences using the technology in methods courses and in schools. Because teacher education faculty already have varying needs and expertise, adequate support must be provided for individual faculty to continue improving their proficiency.

Overall, teacher education faculty are beginning to realize the need to use and integrate computer-related technology throughout courses within a preservice teacher preparation program. Although the progress is slow, results from this study indicate most faculty are improving their personal proficiency to use technology and some faculty are attempting to integrate technology in courses. Additional research studies are needed that focus on teacher education programs that have been successful in using and integrating computer-related technology. While researching these successful programs, it will be important to collect data to help assess the progress that is being made. This information will

then assist teacher education faculty from other teacher preparation programs with their attempts to use and integrate computer-related technology.

Appendix: Dependent T-Test Tables 7-30

Table 7. Descriptive statistics and t-test results for the current and past proficiency for using a computer by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	2.93	.87	<.0001*
Current Proficiency	122	3.40	.55	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for a computer at .05.

Table 8. Descriptive statistics and t-test results for the current and past proficiency for using a camcorder by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	2.23	1.01	<.0001*
Current Proficiency	122	2.84	.83	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a camcorder at .05.

Table 9. Descriptive statistics and t-test results for the current and past proficiency for using video editing equipment by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.34	.69	<.0001*
Current Proficiency	122	1.65	.85	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using video editing equipment at .05.

Table 10. Descriptive statistics and t-test results for the current and past proficiency for using a still video camera by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.49	1.08	<.0001*
Current Proficiency	122	1.91	.90	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a still video camera at .05.

Table 11. Descriptive statistics and t-test results for the current and past proficiency for using a CD ROM by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.21	.59	<.0001*
Current Proficiency	122	2.19	1.03	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a CD ROM at .05.

Table 12. Descriptive statistics and t-test results for the current and past proficiency for using a modem by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.02	1.02	<.0001*
Current Proficiency	122	.87	.87	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a modem at .05.

Table 13. Descriptive statistics and t-test results for the current and past proficiency for using a scanner by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.22	.58	<.0001*
Current Proficiency	122	1.70	.93	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a scanner at .05.

Table 14. Descriptive statistics and t-test results for the current and past proficiency for a laser disc player by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.33	.74	<.0001*
Current Proficiency	122	1.91	1.04	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a laser disc player at .05.

Table 15. Descriptive statistics and t-test results for the current and past proficiency for using a LCD panel by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.27	.67	<.0001*
Current Proficiency	122	1.93	1.06	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a LCD panel at .05.

Table 16. Descriptive statistics and t-test results for the current and past proficiency for using word processing by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	3.03	.88	<.0001*
Current Proficiency	122	3.63	.55	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using word processing at .05.

Table 17. Descriptive statistics and t-test results for the current and past proficiency for using desk top publishing by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.54	.87	<.0001*
Current Proficiency	122	2.04	.97	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using desk top publishing at .05.

Table 18. Descriptive statistics and t-test results for the current and past proficiency for using a database by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.59	.91	<.0001*
Current Proficiency	122	2.28	1.00	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a database at .05.

Table 19. Descriptive statistics and t-test results for the current and past proficiency for using a spreadsheet by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.69	.95	<.0001*
Current Proficiency	122	2.26	1.05	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a spreadsheet at .05.

Table 20. Descriptive statistics and t-test results for the current and past proficiency for using a grading program by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.42	.78	<.0001*
Current Proficiency	122	1.77	.96	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a grading program at .05.

Table 21. Descriptive statistics and t-test results for the current and past proficiency for using a statistics program by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.84	1.01	<.0001*
Current Proficiency	122	2.20	1.01	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a statistics program at .05.

Table 22. Descriptive statistics and t-test results for the current and past proficiency for using a drawing program by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.56	.90	<.0001*
Current Proficiency	122	2.06	1.02	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a drawing program at .05.

Table 23. Descriptive statistics and t-test results for the current and past proficiency for using programming by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.48	.80	.009*
Current Proficiency	122	1.61	.84	

* $p < .05$.

t-test indicates there is no significant difference between the past and current proficiency for using programming at .05.

Table 24. Descriptive statistics and t-test results for the current and past proficiency for using a simulation by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.36	.75	<.0001*
Current Proficiency	122	1.65	.94	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a simulation at .05.

Table 25. Descriptive statistics and t-test results for the current and past proficiency for using problem solving software by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.28	.67	<.0001*
Current Proficiency	122	1.56	.91	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using problem solving software at .05.

Table 26. Descriptive statistics and t-test results for the current and past proficiency for using instructional software by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.71	.92	<.0001*
Current Proficiency	122	2.15	.99	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using instructional software at .05.

Table 27. Descriptive statistics and t-test results for the current and past proficiency for using presentation software by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.30	.71	<.0001*
Current Proficiency	122	1.91	1.10	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using presentation software at .05.

Table 28. Descriptive statistics and t-test results for the current and past proficiency for using a hypermedia program by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.33	.71	<.0001*
Current Proficiency	122	1.80	.90	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using a hypermedia program at .05.

Table 29. Descriptive statistics and t-test results for the current and past proficiency for using LAN communication by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.43	.77	<.0001*
Current Proficiency	122	2.61	1.07	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using LAN communication at .05.

Table 30. Descriptive statistics and t-test results for the current and past proficiency for using the Internet/Bitnet by teacher education faculty from Research I universities

Test	N	Mean	S.D.	P-Value
Past Proficiency	122	1.61	.88	<.0001*
Current Proficiency	122	2.92	.91	

* $p < .05$.

t-test indicates there is a significant difference between the past and current proficiency for using the Internet/Bitnet at .05.

CONCLUSION

Teacher education institutions have a difficult task of preparing teachers for the schools of the 21st century. In reaction to restructuring initiatives taking place in K-12 education, teacher education programs are becoming well aware of the need to restructure their own programs to prepare future teachers (Office of Technology Assessment, 1995; Sheingold & Hadley, 1990). No longer does restructuring refer to just improving upon what is already happening in the classroom, it means creating an educational system where all students are challenged to attain higher performance standards (David, 1995). It will be the responsibility of teacher education institutions to prepare teachers who have new beliefs and practices about instruction that support these restructuring initiatives.

One demand that is gaining momentum in these reform initiatives is the need for colleges of education to prepare future teachers to use technology to support transformation efforts (Office of Technology Assessment, 1995; Olson, 1988). Computer-related technology use in teacher preparation programs is becoming an issue that teacher education faculty must address. As teacher education institutions begin to revise and restructure their own curriculum to accommodate the changing role of the teachers, the instructional tools currently available can be used to help facilitate that change.

Although the use and integration of computer-related technology in teacher preparation programs is not common, several universities have attempted to design approaches that integrate technology into the preservice teacher curriculum. Approaches designed by teacher education faculty have been

isolated at best and in most instances have been addressed by faculty at smaller colleges and universities.

This descriptive research study was designed to assess the use and integration of computer-related technology by teacher education faculty from research one universities. Data gathered from this study described faculty past and current proficiency in using computer-related technology, faculty attitudes toward computer-related technology, and factors that affect faculty use and integration of computer-related technology.

The results from this study indicated that many of the reoccurring themes known to K-12 technology integration are present in teacher preparation programs as well. Time, training and access to equipment are listed by teacher education faculty as their major barriers to using and integrating computer-related technology. Also, teacher education faculty have proficiency using word processors but have made little improvement toward learning about other computer productivity tools or instructional software.

Some results that emerged from these data were not ones commonly expressed by K-12 teachers. Several of the teacher education faculty who responded to this survey indicated that a lot of what they know about computer-related technology resulted in their own perseverance and willingness to learn. Also, teacher education faculty expressed interest in having some type of one-on-one mentoring to support their use and integration of computer-related technology.

As future plans are developed to assist teacher education faculty in their attempts to use and infuse computer-related technology, we must pay close attention to these research results. The experiences preservice teachers have

during their preparation program will effect their future use of computer-related technology in classrooms. It is important that preservice teacher education faculty provide opportunities in their classes for preservice teachers to see how computer-related technology might be used to expand and enhance the curriculum.

REFERENCES

- American Association of Colleges of Teacher Education. (1987). The challenges of electronic technologies for colleges of education. *Journal of Teacher Education*, 38, 25-28.
- Anderson, R. E. & et al. (1993). *Computers in American Schools, 1992: An Overview*. Interantional Association for the Evaluation of Educational Achievement Computers in Education Study. Minneapolis, MN: University of Minnesota. NTIS No. 95-184800.
- Barron, L. C. & Goldman, E. S. (1994) Integrating technology with teacher preparation. In B. Means (Ed.), *Technology and Education Reform* (pp. 81-110). San Francisco, CA: Jossey-Bass Publishers.
- Beaver, J. (1990). *A profile of undergraduate educational technology (in) competence: Are we preparing today's education graduates for teaching in the 1990's?* Buffalo, NY: State University of New York College. (ERIC Document Resporduction Service No. ED 332 985)
- Becker, H. J. (1985). *How schools use microcomputers. Summary of the first national survey* . Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools. (ERIC Document Reproduction Service No. ED 257 448)
- Becker, H. J. (1986). *Instructional uses of school computers: Reports from the 1985 national survey (issue no. 1)*. Baltimore, MD: Johns Hopkins University, Center for Social Organization of Schools.
- Becker, H. J. (1990, April). *Computer use in United States schools: 1989. An initial report of U. S. participation in the I.E.A. computers in education survey*. Paper presented at the annual meeting of the American Educational Research Association, Boston, MA.
- Becker, H. J. (1991). When powerful tools meet conventional beliefs and institutional constraints. *The Computing Teacher*, 18(8), 6-9.
- Becker, H. J. (1994). How exemplary computer-using teachers differ from other teachers: Implications for relizing the potential of computers in schools. *Journal of Research on Computing in Education*, 26(3), 291-321.

- Beichner, R. J. (1993). Technology competencies for new teachers: Issues and solutions. *Journal of Computing in Teacher Education*, 9(3), 111-114.
- Berney, M. F. (1991). A model for evaluating computer education programs. *Journal of Computing in Teacher Education*, 8(2), 11-16.
- Bitter, G. G., & Yohe, R. L. (1989). Preparing teachers for the information age. *Educational Technology*, 29(3), 22-25.
- Borg, W. R. & Gall, M. D. (1989). *Educational Research: An Introduction, Fifth Edition*. White Plains, NY: Longman.
- Brady, H. (1991). New survey summarizes what top technology teachers have learned. *Technology and Learning*, 11(4), 38-39, 43.
- Brooks, D. & Kopp, T. W. (1989). Technology in teacher education. *Journal of Teacher Education*, 40(2), 2-8.
- Brooks, D., & Kopp, T. W. (1990). Technology and teacher education. In W.R. Houston (Eds.), *Handbook of research on teacher education* (pp. 498-513). NY: Macmillan.
- Brownell, G. (1991). The first course in computer education: A survey. *Journal of Computers in Teacher Education*, 7(2), 15-19.
- Brownell, G., & Brownell, N. (1991). Designing tomorrow: Preparing teachers as change agents for the classroom of the future. *Computers in the Schools*, 8(1,2,3), 147-149.
- Brownell, G., & Brownell, N. (1994). A technology course for secondary preservice teachers. *Technology and Teacher Education Annual*, 1994, 431-434. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Bruder, I. (1989). Ninth annual survey of the states. *Electronic Learning*, 9(2), 22-28.
- Bullock, D. W. (1991). California's teacher pre-service computer education requirements: Are they enough for the state and the nation? *Computers in Schools*, 8(1/2/3), 111-114.

- Byrum D. C. & Cashman, C. (1993). Preservice teacher training in educational computing: Problems, perceptions, and preparation. *Journal of Technology and Teacher Education*, 1(3), 259-274.
- Callister, T. A. & Burbles, N. C. (1990). Computer literacy programs in teacher education: What teachers really need to learn. *Computers & Education*, 14(1), 3-7.
- Cashman C. S. & McCraw, P. A. (1994). Meeting the challenge: Training preservice teachers to use technology. *Technology and Teacher Education Annual*, 1994, 438-440. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Chen, M. (1986). Gender and computers: The beneficial effects of experience on attitudes. *Journal of Educational Computing Research*, 2(3), 265-282.
- David, J. L. (1994). Realizing the promise of technology: A policy perspective. In B. Means (Ed.), *Technology and Education Reform* (pp. 169-190). San Francisco, CA: Jossey-Bass Publishers.
- Davis, N. (1993). The development of classroom applications of new technology in pre-service teacher education: A review of the research. *Journal of Technology and Teacher Education*, 1(3), 229-249.
- Davis, N., Willis, J., Fulton, K., & Austin, L. (1995). The current status of technology teacher education: An international comparison. *Technology and Teacher Education Annual* 1995, 801-804. Charlottesville, VA: Association for the Advancement of Computing in Education.
- DeFalco, S. M. & Strang, H. R. (1995). From trait optimism to simulated teaching experience. *Technology and Teacher Education Annual*, 1995, 550-552. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Deim, R. A. (1989). Preservice teachers and computer utilization: A case study. *Educational Technology*, 29(12), 34-36.
- Downes, E. (1992). Integrating technology into teacher education. In D. Carey, R. Carey, D. Willis & J. Willis, *Technology and Teacher Education Annual* 1992, 83-85. Charlottesville, VA: Association for the Advancement of Computing in Education.

- Espinoza, S. & McKinzie, L. (1994). Internet activities open new worlds for educators. *Technology and Teacher Education Annual*, 1994, 666-670. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Fero, G. J. (1992). The development of instructional units in technology for teacher education. *Technology and Teacher Education Annual*, 1992, 80-83. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Fulton, K. (1989). Technology training for teachers: A federal perspective. *Educational Technology*, 12-17.
- Glenn, A. D. & Carrier, C. A. (1989). Teacher education and computer training: An assessment. *Peabody Journal of Education*, 64(1), 67-79.
- Handler, M., & Marshall, D. (1992). Preparing new teachers to use technology: one set of perceptions. *Technology and Teacher Education Annual*, 1992, 386-388. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Harrington, H. (1991). Normal Styletechnology in teacher education: Technology and the education of teachers. *Computers in the Schools*, 8(1/2/3), 49-57.
- Henerson, M. E., Morris, L. L., & Fitz-Simmons, C. T. (1978). *How to measure attitudes*. Beverly Hills, CA: Sage Publications.
- Johnson, D. L. & Harlow, S. D. (1993). Current research in technology and teacher education: Three phases of our mission. In H. C. Waxman and G. W. Bright (Eds.), *Approaches to Research on Teacher Education and Technology*, 61-65. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Kirby, P. C., Wilson, D., & Smith-Gratto, K. (1988). *Survey of computer usage in Louisiana schools*. (ERIC Document Reproduction Service No. ED 305 899)
- Kortecamp, K. & Croninger, W. R. (1995). Integrating technology in preservice education: A model for faculty development. *Technology and Teacher Education Annual*, 1995, 283-286. Charlottesville, VA: Association for the Advancement of Computing in Education.

- Market Data Retrieval. (1993). *Education and technology, 1993: A survey of the K-12 market*. Shelton, CT.
- Mergendoller, J. R. (1994). *Case studies of exemplary approaches to training teachers to use technology*, Washington DC: Office of Technology Assessment Report. NTIS No. 95-170940.
- Minnesota Department of Education. (1989). *Computer tools for teachers: A report*. (Available from Gilbert Valdez, PhD., 684 Capitol Square Building, 550 Cedar Street, St. Paul, MN 55101)
- National Council of Teachers of Mathematics (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: Author.
- Nelson, W. A., Andris, J. & Keefe, D. R. (1991). Technology where they least expect it: A computer-intensive teacher education curriculum. *Computers in Schools*, 8(1/2/3), 103-109.
- Niess, M. L. (1991). Preparing computer-using educators for the 90s. *Journal of Computing in Teacher Education*, 7(2), 11-14.
- Novak, D. I., & Berger, C. F. (1991) Integrating technology into preservice education: Michigan's response. *Computers in the Schools*, 1(1/2/3), 89-101.
- Office of Technology Assessment. (1988). *Power on! New tools for teaching and learning* (Report No. OTA-SET-379). Washington D. C.: U. S. Government Printing Office.
- Office of Technology Assessment. (1995). *Teachers and technology: Making the connection*. (Report no. OTA-EHR-616). Washington, DC: U.S. Government Printing Office.
- Olson, J. (1988). *Schoolworlds/microworlds: Computers nad the culture of the classroom*. Oxford: Pergamon Press.
- Quality Education Data. (1993). *Technology in the public schools: 1992-93*. Denver, CO.
- Schmidt, D. A. (1991). *Iowa survey of computer-related technology use by K-12 teachers*. Unpublished thesis, Iowa State University.

- Schrum, L. (1994). First steps into the information age: Technology infusion in a teacher education program. *Journal of Computing in Teacher Education*, 10(4), 12-14.
- Scrogan, L. (1989). The OTA report: Teachers, training, and technology. *Classroom Computer Learning*, 9(4), 80-85.
- Sheingold, K. & Hadley, M. (1990). *Accomplished teachers: Integrating computers into classroom practice*. (Available from Laura Bryant, Center for TEchnology in Education, Bank Street College of Education, 610 W. 112 St., New York, NY 10025).
- Sheingold, K. (1991). Restructuring for learning with technology: The potential for synergy. *Phi Delta Kapan*, 73(1), 17-27.
- Smith, G. A. (1994). Preparing teachers to restructure schools. *Journal of Teacher Education*, 45(1), 18-30.
- Smith, T. R., Smith, K. A., & Alexander, K. (1995). Faculty technology development model. *Technology and Teacher Education Annual*, 1995, 423-426. Charlottesville, VA: Association for the Advancement of Computing in Education.
- Strudler, N. B. (1991). Education faculty as change agents: Strategies for integrating computers into teacher education programs. *Journal of Computing in Teacher Education*, 8(2), 5-8.
- Thomas, R. & Hooper, E. (1991). Simulations: An opportunity we are missing. *Journal of Research on Computing in Education*, 23(4), 497-511.
- Thompson, A. D., Schmidt, D. A., & Hadjiyianni, E. (1995). A three year program to infuse technology throughout a teacher education program. *Journal of Technology and Teacher Education*, 3(1), 13-24.
- Topp, N. W. (1993). *Teacher preservice experiences and classroom computer use of recent Iowa State University graduates*. Unpublished dissertation: Iowa State University.
- Turner, J. A. (1989). Teacher-training colleges' slow move to computers blamed for schools' lag in integrating technology. *The Chronicle of Higher Education*, 35,(27), 22-23.

- Vagle, R. J. (1994) *Instruction in educational technology for preservice teachers: A model based on current practice of teacher education institutions with exemplary programs for technology in teacher education*. Unpublished doctoral dissertation, University of Northern Colorado.
- Wetzel, K. (1993). Models for achieving computer competencies in preservice education. *Journal of Computing in Teacher Education*, 9(4), 4-6.

ACKNOWLEDGMENTS

Earning this degree gives one the feeling of personal accomplishment and satisfaction, but without the support and help of others throughout the process it might not have become a reality. Personally, there have been many people who have touched my life throughout the last several years that I owe my most sincere thanks and gratitude.

No words can describe the amount of respect and admiration that I have for Dr. Ann Thompson. Simply, she is a remarkable person. The number of professional opportunities that I have had throughout my graduate program has been largely due to Dr. Thompson's genuine interest in me as a student and professional. Because of Dr. Thompson, my graduate program has been one of the most rewarding experiences of my life. Truly, you are an amazing individual!

I wish to thank my other four committee members: Dean Norene Daly, Dr. Donna Merkley, Dr. Anton Netusil, and Dr. Rex Thomas. Each of them contributed to the development of my research study and willingly offered their expertise while I completed the study. To them, I extend my sincere thanks and appreciation for being available when I needed them most.

Fortunately, I had the opportunity to work closely with three incredibly talented individuals during my degree program. A special thanks to Mark, Mary and Janine for their genuine support and encouragement. Collectively, they made this a worthwhile and productive experience for me because of their willingness to share their expertise and knowledge during our 'study and lunch sessions.' These friendships will last a lifetime!

Another friend that I would like to personally thank is Connie. As I

completed my dissertation, she was always willing to help me at any time and at any place. Her support and encouragement were always timely and were greatly appreciated.

Also, I want to thank my dear friend Neal for his never ending interest and support in all the things that I do and accomplish. Neal is always there to brighten my days and to make positive things happen for me. His friendship is a treasure that I am lucky to have found. Also, a special thanks to Linda, Lynelle and Greg for welcoming me into your family. All of you will always hold a special place in my heart.

Finally, I would like to thank my family for their love and support throughout my graduate program. Mom, you are the greatest! Your motherly instinct must have told you when I needed you most because you were always there to offer encouraging words or loving hugs. Thank you Grandma, for all the wonderful visits we have had and the delicious cookies that were always ready for my return to Ames. Two people that I have looked up to all of my life are my older brothers, Brian and Craig. How lucky (or spoiled) I have been over the years to have grown up with these two exceptional individuals. Thank you for always supporting and encouraging your little sister's dreams. Jane, my sincere thanks for all the kind things you do for me. Kate, Ben, and Sam are my inspiration. Remember, you three don't have to call me "Dr. Aunt Denise."

Probably my biggest disappointment is that my father is not here to share and celebrate this accomplishment with me. Something tells me the boss would have been excited about this one!

**APPENDIX A:
COVER LETTER AND SAMPLE QUESTIONNAIRE**

IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

College of Education
Department of Curriculum and Instruction
N157 Lagomarcino Hall
Ames, Iowa 50011-3190
515 294-7603
FAX 515 294-6200

May 4, 1995

Dear Teacher Education Faculty Member:

Computer-related technologies have become an integral part of our educational environment. The integration of these technologies throughout the teacher education program has become a critical issue facing teacher educators. The College of Education at Iowa State University is conducting a survey of teacher education faculty to gather data on the progress of computer-related technology integration in teacher education programs and to investigate factors that may help or hinder the use of these technologies by teacher education faculty.

Teacher education faculty from several of the Land Grant Eleven institutions are participating in this study. Your participation is voluntary but very critical to the success of the study. To ensure that the information collected accurately represents how the teacher education faculty at your institution are using and integrating computer-related technologies, it is extremely important that this questionnaire is completed and returned. It will take you 15-30 minutes to complete the questionnaire.

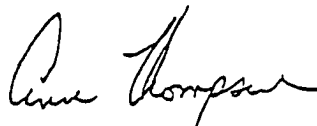
Be assured that your questionnaire will be handled with strict confidence. An identification number has been assigned to the survey sent to you. Your name will be checked off the mailing list using this identification number when the survey is returned. At no time will the completed questionnaire be associated with your name.

Please return the questionnaire in the enclosed self-addressed postage-paid envelope by Friday, May 19. Your college and department will receive a document that reports the results from this study next Fall. If you have any questions about the study or for any reasons are unable to complete the survey, please call Ann Thompson at (515) 294-5287. Thank you.

Sincerely,



Norene F. Daly, Dean
College of Education
Iowa State University



Ann D. Thompson, Chair
Department of Curriculum and Instruction
Iowa State University

A Survey of the Use and Integration of Computer-Related Technology by Teacher Education Faculty

This survey is designed to be completed by teacher education faculty to report their use and integration of computer-related technologies. Survey items address the following themes: background information, current and past proficiency for using computer-related technology, faculty attitudes toward computer-related technology, the integration of computer-related technology in a teacher education program, and the support necessary for computer-related technology integration.

All information that you supply will be kept strictly confidential. No individual will ever be identified in any reports. Thank you for your responses. Your assistance is very much appreciated.

Section I: Background Information

This section will be used to gather background information about you. Please circle the letter which best answers each question or fill in the blank with your response.

1. What is your gender?
 - a. Female
 - b. Male
2. What is your current age? _____ years
3. Including the current academic year, how many years of experience have you had as an educator in higher education? _____ years
4. What is your current academic rank/title?
 - a. Full Professor
 - b. Associate Professor
 - c. Assistant Professor
 - d. Instructor
 - e. Other (explain) _____
5. Which of the following courses do you teach (circle all that apply)?
 - a. undergraduate educational foundations course
 - b. undergraduate education methods course
 - c. undergraduate subject-specific course
 - d. undergraduate special education course
 - e. undergraduate technology specific course
 - f. undergraduate field experience course
 - g. graduate course
 - h. other (explain) _____
6. Do you have a computer in your faculty office?
 - a. yes
 - b. no
7. Including the current academic year, how long have you had a computer in your faculty office?
_____ years

Section II: Current Proficiency Using Computer-Related Technology

Responses to this section will indicate your current proficiency using various instructional technology equipment and computer-related technology applications.

Please indicate your current proficiency using the following instructional technology equipment. Please circle the number that best describes your current proficiency using the scale below.

- 1) No proficiency
- 2) Little proficiency
- 3) Moderate proficiency
- 4) High proficiency

	No	Little	Moder.	High
1. Computer.....	1	2	3	4
2. Camcorder.....	1	2	3	4
3. Video editing equipment.....	1	2	3	4
4. Still video camera (e.g., Cannon Xap Shot, Apple Quicktake).....	1	2	3	4
5. CD-ROM player.....	1	2	3	4
6. Modem.....	1	2	3	4
7. Distance education system.....	1	2	3	4
8. Scanner.....	1	2	3	4
9. Laser disc player.....	1	2	3	4
10. LCD panel (i.e., computer projection device).....	1	2	3	4

For the following items, please indicate your current proficiency using these computer-related technology applications. Please circle the number that best describes your current proficiency using the scale below.

- 1) No proficiency
- 2) Little proficiency
- 3) Moderate proficiency
- 4) High proficiency

	No	Little	Moder.	High
11. Word processing.....	1	2	3	4
12. Desktop publishing (e.g., Children's Writing and Publishing Center, The Writing Center, Pagemaker).....	1	2	3	4
13. Database management program.....	1	2	3	4
14. Spreadsheet.....	1	2	3	4
15. Grading program.....	1	2	3	4
16. Statistical program (e.g., Stat View, SPSS).....	1	2	3	4
17. Drawing program.....	1	2	3	4
18. Programming.....	1	2	3	4
19. Simulation.....	1	2	3	4
20. Problem solving software.....	1	2	3	4
21. Instructional software (e.g., tutorials, drill and practice).....	1	2	3	4
22. Presentation software (e.g., PowerPoint, Persuasion).....	1	2	3	4
23. Hypermedia program (e.g., Hyperstudio, Hypercard, Linkway).....	1	2	3	4
24. Local area network communication (e.g., Quick Mail).....	1	2	3	4
25. Internet.....	1	2	3	4

Section III: Past Proficiency Using Computer-Related Technology

Responses to this section will indicate how proficient you were in using various instructional technology equipment and computer-related technology applications five years ago (during the 1989-1990 academic year).

Please think back five years ago (during the 1989-1990 academic year) and indicate to the best of your ability, how proficient you were using the following instructional technology equipment. Please circle the number that best describes your proficiency five years ago using the scale below.

- 1) Had no proficiency
- 2) Had little proficiency
- 3) Had moderate proficiency
- 4) Had high proficiency

	No	Little	Moder.	High
1. Computer.....	1	2	3	4
2. Camcorder.....	1	2	3	4
3. Video editing equipment.....	1	2	3	4
4. Still video camera (e.g., Cannon Xap Shot, Apple Quicktake).....	1	2	3	4
5. CD-ROM player.....	1	2	3	4
6. Modem.....	1	2	3	4
7. Distance education system.....	1	2	3	4
8. Scanner.....	1	2	3	4
9. Laser disc player.....	1	2	3	4
10. LCD panel (i.e., computer projection device).....	1	2	3	4

Again, please think back five years ago (during the 1989-1990 academic year) and indicate to the best of your ability, how proficient you were using the following computer-related technology applications. Please circle the number that best describes your proficiency five years ago using the scale below.

- 1) Had no proficiency
- 2) Had little proficiency
- 3) Had moderate proficiency
- 4) Had high proficiency

	No	Little	Moder.	High
11. Word processing.....	1	2	3	4
12. Desktop publishing (e.g., Children's Writing and Publishing Center, The Writing Center, Pagemaker).....	1	2	3	4
13. Database management program.....	1	2	3	4
14. Spreadsheet.....	1	2	3	4
15. Grading program.....	1	2	3	4
16. Statistical program (e.g., Stat View, SPSS).....	1	2	3	4
17. Drawing program.....	1	2	3	4
18. Programming.....	1	2	3	4
19. Simulation.....	1	2	3	4
20. Problem solving software.....	1	2	3	4
21. Instructional software (e.g., tutorials, drill and practice).....	1	2	3	4
22. Presentation software (e.g., PowerPoint, Persuasion).....	1	2	3	4
23. Hypermedia program (e.g., Hyperstudio, Hypercard, Linkway).....	1	2	3	4
24. Local area network communication (e.g., Quick Mail).....	1	2	3	4
25. Internet/Bitnet.....	1	2	3	4

Using the scale below, please circle the number that best indicates your response.

	1	2	3	4	5
	Very Inadequate	Inadequate	Adequate	More than Adequate	Outstanding
26. Which best describes your overall current proficiency for using computer-related technologies?.....	1	2	3	4	5
27. Which best describes your departmental peers' current overall proficiency for using computer-related technologies?.....	1	2	3	4	5
28. Which best describes your students' current overall proficiency for using computer-related technologies?.....	1	2	3	4	5

Section IV: Attitudes Toward Computer-Related Technology

To what extent do each of the following statements characterize your attitudes toward computer-related technology. Using the scale below, indicate the extent to which you agree or disagree with each statement by circling your response. Please circle only one number per question.

	1	2	3	4	5
	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
	SD	D	U	A	SA
1. I am comfortable using computer-related technologies for my own work.....	1	2	3	4	5
2. Computers are valuable tools that can be used to improve the quality of education.....	1	2	3	4	5
3. It has been a struggle for me to learn how to successfully use a computer.....	1	2	3	4	5
4. I lack confidence in using a computer to complete my work.....	1	2	3	4	5
5. Computer-related technologies should be used by faculty more than they are now.....	1	2	3	4	5
6. I do not feel threatened by computers.....	1	2	3	4	5
7. I think computers make my professional work more difficult.....	1	2	3	4	5
8. In the future, I will integrate computer-related technology much more for teaching.....	1	2	3	4	5
9. Computer-related technologies are of little value for instruction because they are too difficult to use.....	1	2	3	4	5
10. Overall, I think the computer is a very important instructional tool.....	1	2	3	4	5
11. I do not feel comfortable using computer-related technologies in my teaching..	1	2	3	4	5
12. I would like to improve my skills using computer-related technologies.....	1	2	3	4	5
13. I feel it is important for educators to be able to use computer-related technology.....	1	2	3	4	5
14. Computer-related technologies should be used to improve learning throughout the curriculum.....	1	2	3	4	5
15. I think computers make work more enjoyable.....	1	2	3	4	5

Section V: Integration of Computer-Related Technology into a Teacher Education Program

Responses from this section will indicate how computer-related technology is being integrated into the teacher education program by faculty. Please respond to all the questions that are applicable to your current teaching situation.

1. If you are currently integrating computer-related technology into the course(s) you teach, please describe one factor that helped you learn how to integrate these technologies into your course(s).

2. From the list below, rank the top five reasons (with 1 being most important) why you use or would use computer-related technologies in your course(s).

- _____ Addresses multiple student learning styles
- _____ Addresses a departmental goal
- _____ Encourages active student learning
- _____ Facilitates individualized instruction
- _____ Addresses expectations of administration
- _____ Addresses the demands of the university reward structure
- _____ Enables learning experiences otherwise impossible
- _____ Enhances student learning
- _____ Addresses the expectations of departmental peers
- _____ Helps prepare students to teach in future school settings
- _____ Addresses personal satisfaction
- _____ Supports university's mission
- _____ Assists student learning
- _____ Addresses expectations of K-12 school administration and teachers
- _____ Addresses expectations of college students
- _____ Encourages me to try new things in my teaching
- _____ Models effective uses of technology for teaching and learning
- _____ Other _____
- _____ Other _____

3. From the list below, rank the top five barriers (with 1 being the barrier that most impedes your use) you encounter in using or trying to use computer-related technologies in your course(s).

- _____ Lack of available equipment
- _____ Lack of personal comfort with using technology
- _____ Not applicable to the course subject matter
- _____ Lack of time to learn new technologies
- _____ Lack of training to use new technologies
- _____ Students are not ready to use technologies
- _____ K-12 schools do not expect teachers to use technologies
- _____ Lack of software for the courses you teach
- _____ Technology does not enhance student learning
- _____ Lack of technical support for using technology
- _____ Not enough class time, too many topics to teach already
- _____ Students do not feel technology is important for learning course content
- _____ Lack of administrative support for using technology
- _____ Other _____
- _____ Other _____

4. If any support for integrating computer-related technology in teaching is or has been available to you, describe below the ways this support is or has been provided. Please list the most important means of support given to you first.

- a. _____
- b. _____
- c. _____
- _____

5. What type of additional support for integrating computer-related technology would be most useful to you? Please list your suggestions below, listing the most important suggestion first.

- a. _____
- b. _____
- c. _____
- _____

6. Briefly describe your most successful use of computer-related technology in teaching.

7. Please write additional comments, suggestions, or concerns.

Please return this survey in the postage-paid self-addressed envelope provided by Friday, May 19.
Thank you again for taking the time to complete this survey.

**APPENDIX B:
REMINDER POSTCARD AND FOLLOW-UP LETTER**

This appendix contains the reminder postcard and follow-up letter that were sent to non respondents. The follow-up letter was sent with a second copy of the survey.

May 15, 1995

Dear Teacher Education Faculty Member:

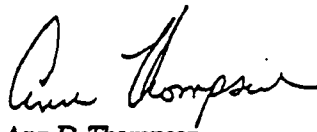
We would very much like to include your responses in our study of the use and integration of computer-related technologies by teacher education faculty. If you have returned the questionnaire recently, we want to express our thanks to you.

If you have not returned your questionnaire, please complete it and return it as soon as possible. Thank you.

Sincerely,



Norene F. Daly
College of Education
Iowa State University



Ann D. Thompson
Department of Curriculum and Instruction
Iowa State University

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

College of Education
Department of Curriculum and Instruction
N157 Ligonarcino Hall
Ames, Iowa 50011-3190
515 294-7603
FAX 515 294-0200

June 8, 1995

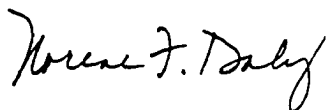
Dear Teacher Education Faculty Member:

In May we sent you a survey concerning the use and integration of computer-related technology by teacher education faculty. If you have already returned the survey, we would like to express our thanks. If you have not yet returned the survey, we would still very much like to include your responses in our study.

We are attempting to obtain as many responses as possible so the results represent how teacher education faculty use and integrate computer-related technology. Responses from faculty who do not use technology are just as important as responses from faculty who use technology. Enclosed is another survey and return postage paid envelope. We realize you have an extremely busy schedule, but please take 15-30 minutes to complete the survey. Your questionnaire will be handled with strict confidence and at no time will the completed questionnaire be associated with your name.

Please return the completed questionnaire by Friday, June 23. If you have any questions about the study or for any reasons are unable to complete the survey, please call Ann Thompson at (515) 294-5287. Thank you for your continued cooperation.

Sincerely,



Norene F. Daly, Dean
College of Education
Iowa State University



Ann D. Thompson, Chair
Department of Curriculum and Instruction
Iowa State University

**APPENDIX C:
SURVEY ITEMS INCLUDED IN EACH ATTITUDE FACTOR
AND FACTOR LOADINGS**

This appendix contains a descriptive list of the individual items and factor loadings for the two identified attitude factors.

**APPENDIX C:
SURVEY ITEMS INCLUDED IN EACH ATTITUDE FACTOR
AND FACTOR LOADINGS**

Factor 1: General Attitude Toward Computer-Related Technology

- item 2 - Computers are valuable tools that can be used to improve the quality of education. (.65)
- item 5 - Computer-related technologies should be used by faculty more than they are now. (.65)
- item 8 - In the future, I will integrate computer-related technology much more for teaching. (.65)
- item 9 - Computer-related technologies are of little value for instruction because they are too difficult to use. (.62)
- item 10 - Overall, I think the computer is a very important instructional tool. (.68)
- item 12 - I would like to improve my skills using computer-related technologies. (.69)
- item 13 - I feel it is important for educators to be able to use computer-related technology. (.82)
- item 14 - Computer-related technologies should be used to improve learning throughout the curriculum. (.68)
- item 15 - I think computers make work more enjoyable. (.54)

Factor 2: Confidence Toward Using Computer-Related Technology

- item 1 - I am comfortable using computer-related technologies for my own work. (.72)
- item 3 - It has been a struggle for me to learn how to successfully use a computer. (.65)
- item 4 - I lack confidence in using a computer to complete my work. (.78)
- item 6 - I do not feel threatened by computers. (.75)
- item 7 - I think computers make my professional work more difficult. (.55)
- item 11 - I do not feel comfortable using computer-related technologies in my teaching. (.75)

**APPENDIX D:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 1, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"If you are currently integrating computer-related technology into the course(s) you teach, please describe one factor that helped you learn how to integrate these technologies into your course(s)."

**APPENDIX D:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 1, SECTION V**

Participated in peer mentoring program with graduate students

I participated in a mentoring program with a graduate student.

Mentoring aspect of the departmental three year plan.

Having graduate students available to help me.

The assignment of a teaching assistant to assist me.

"Each one teach one" concept - that course where grad students paired with a faculty member.

Learned about technology by personal exploration

Trial and error.

Trial and error - After thinking about what I could do, I did some reading and then 'tried' some things. After some success, I began to fine tune.

Using the technology myself and having access to it so I could use it. I've got plenty of ideas, I just need the easy access and time to integrate it.

I used to teach a computer course; therefore I explored things on my own. A graduate student has also attempted to teach me.

Received assistance from another faculty member

Talking with other faculty about how they use the computer in their classes.

A research assistant sought assistance (at my direction) from an educational computing staff member.

Worked directly with another faculty member to develop some ideas.

Attended workshops and conferences

Going to workshops and conferences.

Powerpoint, etc. demonstrations in department.

Identified the need to integrate technology to support teaching and learning

I saw an application of the theory to teaching the students. I could see how it would help me 'teach' what I wanted to teach.

New software (interactive programs and CD ROM programs) makes integration of technology relevant, interesting.

Observed technology use modeled by others

Models provided by peers.

Watching people who use them more often or with more expertise.

Provided easy access to hardware and software

Having the ability to access programs for the IRC to preview and play with.

Unfortunately, it takes time that isn't always available.

Availability of the computer cart for class use.

Other

Ease of use of software.

Help from computer lab personnel has been appreciated.

**APPENDIX E:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 4, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"If any support for integrating computer-related technology in teaching is or has been available to you, describe below the ways this support is or has been provided. Please list the most important means of support given to you first."

**APPENDIX E:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 4, SECTION V**

Workshops/seminars provided within the college

- Workshops given by computer lab personnel. (1)
- Seminar with college technology support person. (1)
- Workshops. (1)
- E-mail workshop. (2)
- Lunch time seminars on new technologies. (2)
- Workshops for faculty. (2)
- Presentations by college technology support person. (2)
- I attended a session on how to use a grading program. (2)
- Internet seminar. (2)
- Planned inservice & 'Software of the Week.' (2)
- The workshops that RISE put on. (3)

Easy access to hardware and software

- Having the technology easily available so I can use and get comfortable with it. (1)
- I teach in an NSF model classroom (It has a lot of hard/software)
- Providing a computer on my desk. (1)
- Presence of computer in office. (1)
- Availability of equipment (computer labs and teaching stations). (1)
- Up-to-date-equipment. (2)
- I've been able to practice using software on my own office computer. (3)

Support from faculty member(s)

- Colleagues advice/instruction. (1)
- Computer lab coordinator has been helpful in fielding questions. (1)
- Colleague assistance/advice/demonstration esp. mentoring. (1)
- Another faculty member has been important for providing motivation to use technology. (2)
- Visiting with other faculty. (2)
- Colleagues. (2)

Support from graduate student(s)

- Graduate student who is always willing to help. (1)
- An educational computer major (Ph.D.) designed a program for me. (1)
- Graduate students. (1)
- Office mate - graduate student - has been very encouraging because I can ask her all my 'dumb' questions at anytime. (2)
- Having a graduate student paid to work with me. (2)

Financial support for technology hardware and software purchases

- Money for software and hardware. (1)
- Financial support to purchase new hardware and software. (2)
- I've been able to secure software with student fees. (2)
- Financial support to integrate (ICN sessions). (2)
- Funds for software. (3)

Technical support provided within the college

- College technology support person. (1)
- Hardware and technical support. (1)
- Making certain technology is functioning at class time and assistance with students questions. Much of the time is spent on technology questions and not on learning content of the course. (1)

Peer mentoring program with graduate students

- Personal 1 to 1 help. (1)
- Grad student assigned to help me (part of a tech course). (1)
- Providing a graduate student to assist me develop infusion. (2)

Support from department administration

- Departmental support (expectations) to use technology. (1)
- Support and encouragement from department administration. (2)

No support provided

- none. (1)

Technical support provided outside of the college

- I've hired a consultant to come to my home and personally provide very meaningful sessions to address needs, concerns, problems I have to use new programs, etc. I paid for this myself. The consultant was from the private sector, not ISU. (2)

Other

- Course work assignments (i.e., 510 really inspired me). (1)
- Bringing a graduate class to view undergraduate demonstrations of software. (1)
- Having directions/newsletters to learn about what is available and how to access Internet. (3)
- Computer center courses. (3)
- Secretaries. (3)
- Strong models of effective techniques for integrating technology into the classroom. (3)

**APPENDIX F:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 5, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"What type of additional support for integrating computer-related technology would be most useful to you? Please list your suggestions below, listing the most important suggestion first."

**APPENDIX F:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 5, SECTION V**

Provide easier access to hardware and software

- Easier access to 'cart.' (1)
- Access to technology - easier - people tend to be stingy and territorial. (1)
- Computer and LCD for each classroom where I teach. (1)
- More and readily available equipment. (1)
- More equipment available to use and an invitation to use it - to everyone not just a select few. (1)
- Having software to checkout to use at home when have time. (2)
- Easier access to equipment so there aren't so many hoops to jump through. (2)
- Having video players in rooms - through doors etc. and having it available before 8:00 classes. (3)
- Equipment in teaching classrooms for use at a moments notice so it becomes a natural part of teaching. (3)
- Technology equipped classrooms so we don't have to kill the equipment taking it across the bricks to get to class and functioning equipment in rooms so that it can be darkened etc. if need be! (3)

Provide additional workshops/seminars within the college

- More workshops. (1)
- Continued inservice for ISU faculty/staff! (e.g., Internet, stat program, Powerpoint). (1)
- Perhaps workshops that focus on particular area of teacher preparation. (1)
- Offer some instruction at multiple times - we often have schedule conflicts not a lack on interest in attending the sessions. (2)
- Continue workshops on topics like Powerpoint, World Wide Web, etc. (2)
- Computer training programs. (3)
- More workshops. (3)

Continue/expand peer mentoring program with graduate student(s)

- Continued mentoring and workshops. (1)
- A resource person to look at my course content and make concrete suggestions and provide training. (1)
- Someone who will 'visit' and help design ways to integrate technology - sounding board. (2)
- Providing a teaching assistant to assist with infusion and set up hardware. (2)
- One mentor assigned to me to teach me. (2)

Acquire more hardware and update current hardware in place

- Faster and more current computer hardware. (1)
- I wish for a newer computer - I know that takes \$. (1)
- Line-item funding for keeping computer labs updated with current equipment. (1)
- Need C U See Me on many of our computers. (2)
- Upgraded equipment in offices. (3)

Provide more time

- Time. (1)
- Release time - analogous to release time for research. (1)
- Time to learn programs. (1)
- Release time or some reward to encourage people to integrate more. (3)

Organize small mentoring groups for interested faculty

- Technology tutor for small group - perhaps grad students. (1)
- A skilled assistant (mentor)/graduate student assigned to help faculty; one who has time to do just that for one academic year with a few faculty members who need/want help. (1)
- I wish technology person could come to our section meetings and make suggestions or help us set goals. (2)
- A staff member assigned to a group of faculty. (2)

Provide access to computer and/or modem at home

- Having access to the Internet at home. (1)
- Need better access to Vincent and Internet from home (modem access from home is difficult because Durham has too few ports). (1)
- Providing a computer for use at home - some departments in engineering get to take their old ones home. (1)

Purchase more software

- More software for secondary level. (2)
- More CDs for faculty to check out for the NSF classroom. (3)

Provide opportunities to watch others model technology use in the classroom

- Watching others model use. (1)

Share information about new software and hardware purchased

- Software reviews. (2)

Share technology journal articles with faculty

- Sharing pertinent journal articles among faculty. (2)

Provide more hardware for student checkout

More powerbooks for student checkout. (2)

Other

More formal and informal mechanisms to discuss and critique the subject.
(1)

Help to make certain technology function. (1)

New models for conceptualizing what technology in the classroom can be.
(2)

Classroom applications. (2)

**APPENDIX G:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 6, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"Briefly describe your most successful use of computer-related technology in teaching."

**APPENDIX G:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 6, SECTION V**

Level One Use - Discussion/Demonstration

(Professor demonstrates or discusses how technology can be used in K-12 classrooms.)

Reading and Writing Across the Curriculum - Use of five specific types of tools software enhanced curriculum delivery and assessment.

Powerpoint for selected presentations assisted in clarity and pacing of the content delivery.

The use of Powerpoint in presentation.

Using the LCD station.

Showing the different software that is available in my subject area.

My prepared materials (i.e., handouts, transparencies) look professional and creative.

I email other university faculty in my area about ideas and activities in our discipline.

With the assistance of a Curriculum and Instructional Technology doctoral student, I computerized a phonics test and reading level test. I demonstrate the former in my undergraduate and graduate reading methods classes.

Powerpoint has also been really promising and I've got great presentations I could use, but it is (not easy) to try to get the equipment into the classroom (if I'm lucky enough to get access to it) that I don't use it nearly as much as I'd like.

Presentations using Powerpoint.

Word processing to type materials (syllabus, etc.) for class use.

Using and inspiring students to create, creative Powerpoint presentations.

Level Two Use - Technology Practice

(Preservice teachers learn how to use technology through hands-on experiences and practice)

Being able to take class to lab to do an assignment which allows them to learn about writing programs available. The problem that I can't help them often because I don't know all the programs that well to troubleshoot.

Use of Inspiration for concept mapping.

Word processing.

Using the computer labs for writing process workshops.

Because of the nature of my classes, the best use of technology is email. I am having students journal via email - some of the time.

Students use interactive software (i.e., problem solving and simulation) as well as video laser disks, CD ROM software in my discipline.

I require all students to be on email and I communicate with each student at least once.

Students create newsletters using *The Writing Center* program.

Using computer for email and notes, memos, to students and faculty.

Going to the computer labs to learn about the writing process and experience how technology can facilitate this process.

Had a station class where students rotated through use of CD ROMs, publishing and various software programs.

Using Internet and email to open my classroom to the world and bring the world to my classroom has been incredibly successful. This has also helped connect me so much more with my students and I think has helped them connect so much more with me too. It has also been great for them to find out how much is out there on the NET.

With other colleagues technology field trips were created using CDs (e.g., San Diego Zoo, Persian Gulf War) and questions about my content were asked. Reason? We can't afford to take 60 students to CALIFORNIA OR TO SAUDI back in time.

Student presentations of major projects (e.g., Hypercard stack, use of Powerpoint for presentation of data or reports).

Level Three Use - Professional Practice

(Preservice teachers observe K-12 teachers using technology and/or practice teaching with technology)

Use of Logo to help elementary teachers understand constructivist views in teaching math.

The use of Internet/distance education to connect preservice teachers to the 'real' classroom.

Simulated parent-teacher communication using Writers Workshop (completed by students).

Use of laptops when writing Individual Education Plans (IEPs) in methods class.

Students use technology in 'micro' lessons taught in my class. (e.g., LCD panel, CD ROM).

Hmmm, a tough one. I guess the email activity in the math methods course to encourage the development of the preservice teachers' ability to help elementary students to learn problem solving skills.

**APPENDIX H:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 7, SECTION V**

This appendix contains any additional written comments, suggestions, or concerns made by Iowa State University respondents.

**APPENDIX H:
IOWA STATE UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 7, SECTION V**

I feel most limited by my personal lack of creativity. I'm not scared or worried about course curriculum (time) I just can't think about good ideas. I have to 'steal' them. Perhaps there are some journals to which C & I could subscribe that have tons of ideas in them??

I think the climate in the Department is one that strongly encourages the use of technology in our curriculum. This is very important if we expect all faculty members to integrate technology into their curriculum.

We have to make it easier for instructors to use technology or they aren't going to use it. I see people trying. Those in technology equipped rooms don't know what the others of us go through just to try to integrate it. It can be VERY frustrating even for those of us who really believe it is essential.

Critical pedagogy perspectives need to be a part of the use and integration of computer-related technology into teacher education courses.

I feel strongly about release time for faculty to pursue ways of integrating computer-related technology in teaching.

I know I have a lot to learn in this area, but my confidence and attitude is positive. I hope to model this behavior for preservice teachers.

I'm thrilled to be learning new ways to be skillful in my teaching through using technology. It is one of the aspects of my job which I love the most. I'm just not as proficient as I'd like to be. More time and training opportunities would be welcomed. I've purchased a powerful computer for my home and do most of my work and email, Internet there. The Lago hardware is slow and limiting.

Thanks for asking. I think the C & I Department is making good progress in use of technology.

I don't necessarily find the people downstairs overly friendly and helpful to faculty!

**APPENDIX I:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 1, SECTION V**

This appendix contains the Peer University faculty written responses to the following open-ended question:

"If you are currently integrating computer-related technology into the course(s) you teach, please describe one factor that helped you learn how to integrate these technologies into your course(s)."

**APPENDIX I:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 1, SECTION V**

Learned about technology by personal exploration

Using the computer and software myself and having it be a rewarding endeavor.

I am self-motivated and it is through my own perseverance that I have learned to do this (as opposed to any external factor).

Willingness to experiment.

My own use of database, email, word processing convinced me of this value and developed my skills. I now require students to communicate with me via email, and encourage other uses. Their experiences of the power and efficiency promotes their learning and use.

The chance to use it myself as a learner and talk about uses with others. Doing it.

I had to do it myself - the use of email to develop a network system for communicating between a school site and university (individual upload of work).

Using the computer myself.

Find something interesting and experiment.

Using the technologies myself.

What motivated me was local schools already using technology that we were not as teacher educators. How I learned to use the technology was through the "School of Hard Knocks". Self taught was the major method used.

My own time spent playing around with the software and investigating the materials that came with it.

Willingness to try, willingness to start.

My willingness to try to do it.

Personal hands-on experience is essential for planning experiences for students.

Received assistance from faculty member(s)

Colleagues helping me.

A competent friendly colleague willing to share knowledge.

Visiting with a faculty member whose expertise is in computer-assisted technology. He gave me several ideas that I could incorporate and offered his assistance.

Study group - Participating with colleagues in a study group using hypermedia materials.

I am just beginning to integrate computer-related technology into the courses I teach. It appears that the major factor that will enable me to do so is mentorship by more knowledgeable peers, a process that will likely become programmatic and institutionalized.

A computer literate colleague who provided needed support.

The group of faculty that teaches the same course as I do require students to use word processing, e-mail, and paint and draw.

Working with others with computer expertise.

I am a member of a Teacher Education study group that has been exploring a collection of hypermedia materials and how we might use them in courses.

I participated in a year-long study group that met bi-monthly. It provided technical support.

Demonstrations of colleagues.

Examples and help from other faculty.

Use of interactive video due to NSF grant and educational technology co-project director.

Used communication technologies (e.g., email) to communicate with students and colleagues

Email discussion groups.

My own experience with using e-mail to communicate with colleagues.

The one computer-related technology I use relative to my courses is email.

I can't think of anything that "helped" per se. I use it because it is convenient (for me, though not necessarily for my students) and because I believe students should become knowledgeable about using email.

Need to foster communication between students using listservs.

In teaching graduate courses I communicate with students concerning projects and papers. For example, I often respond to prospectus or plan for projects using email.

Need to better communicate.

Identified the need to integrate technology to support teaching and learning

"Technology as a tool" - showing how to use technology appropriately.

Recognizing that it is important to integrate computer-related technology and persisting----

Willingness to accept computers as one more tool to use to enhance learning - no better no worse than other tools (i.e., overhead projector) just one more tool with it's own specific powerful uses.

Relevance to the course - that is, I was using the software I was explaining how to use (e.g., Powerpoint).

As a research tool (CD ROM, THOR, etc.), papers are word processed.

My own desire to do so effectively, as a means to model this for students.

Received support from someone else

We have a facility for faculty development related to computer technologies. The staff in this facility work with faculty to improve their computer skills and prepare demonstrations for classes.

One on one instruction.

Help from friends.

My spouse.

Someone to teach me how to use the technology.

Collaborating with others, opportunities to do so.

The Instructional Resource Center was extremely helpful in answering my questions. They also put on workshops.

Faculty workshops provided by department.

Provided easy access to hardware and software

Access to hardware and software - support for teaching new applications.

A reason to use technology (e.g., An exciting simulation that really fits my teaching goals.)

Availability

The one factor is the availability of multimedia-media machines tied to an LCD.

I have a Mac. Our students were issued Mac Powerbooks. I made contact with our technology faculty and we started. We are all on Internet.
Guess what we started with?

Received assistance from graduate student(s)

Access to other faculty (i.e., grad students) who are knowledgeable.

Working with graduate students in curriculum and instructional systems who are knowledgeable.

Graduate students who were already proficient helped me.

Learned from undergraduate students

Students visit a school with technology to observe and participate in activities.

I'm still learning. I think what has helped me most are knowledgeable students who I can rely on in classes.

Students came in with skills, and I learned from them.

Time

Time to experiment.

Time.

Other

Conferences and readings.

Graduate course on change in finding creative solutions. Undergraduate course in transportation using the computer to do statistical work from results of student competition.

Word processing for students writing.

Course presentation software (e.g., Powerpoint)

**APPENDIX J:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 4, SECTION V**

This appendix contains the peer university faculty written responses to the following open-ended question:

"If any support for integrating computer-related technology in teaching is or has been available to you, describe below the ways this support is or has been provided. Please list the most important means of support given to you first."

**APPENDIX J:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 4, SECTION V**

Easy access to hardware and software

- We have a computer lab in the college; the lab has a variety of computers and a sample of instructional software. (1)
- Lab (computer) facilities for student use and occasional class use. Equipment. (1)
- College laboratory recently became available. (1)
- Hardware and software is provided. (1)
- Provide computer. (1)
- A computer in my office linked to the Internet. (1)
- Access to the network. (1)
- A computer in my office. (1)
- Computer labs and network installed. (1)
- Access to basic equipment. (1)
- We have state-of-the-art instructional facilities. (1)
- We have excellent computer facilities. (1)
- E-mail, Internet. (1)
- In-room projection hardware. (1)
- We are very limited on use of "LCD's" or classrooms setup with computer aided technology. (1)
- The students have Mac Powerbooks. (2)
- Announcements on Internet. (2)
- Some equipment available. (2)
- State of art personal computer. (2)
- Available equipment - not always state of the art, but adequate. (2)
- Availability of current equipment. (2)
- There is a computer lab in this building. (3)
- I have a Power Mac 6100/60 and am hard wired. (3)
- We have all the computer programs one could need or want. (3)

Technical support provided within the college

- We have computer lab whose personnel are helpful. (1)
- We have a computer lab and staff available to team teach with. (1)
- Available consultants to answer questions. (1)
- Computer-tech support staff who provide answers to specific problems. (1)
- Available support - sometimes. (1)
- Technical support person available through administration. (1)
- One on one instruction - Internet. (1)
- Hardware maintenance. (1)

Lab and technicians are helpful. (1)
 Technology person to upgrade software and skills and training sessions
 (who is now overloaded). (1)
 Director and consultants in computer lab very helpful in familiarizing
 with equipment. (1)
 The continual availability of experts. (2)
 Technical support to set up new software and update the net. (2)
 Our center for learning technologies. (2)
 College technical support. (2)
 Some support through trained staff but not enough. (2)
 Technical support person - helps with set-up. (2)
 We have computer support staff available (not always competent). (2)
 Computer assistants who are readily available. (3)
 Adequate support staff to help with solving problems. (3)
 Technical assistance from school of education technical support person. (3)

Workshops/seminars provided within the college

Workshops. (1)
 Workshops. (1)
 Workshops. (1)
 Workshops within the department and college (of education). (1)
 Providing opportunities to "play around" with new hardware and
 software in supported situations. (1)
 Recently, College of Education opened a Center that demonstrates
 software. (1)
 As part of Professional Development School (PDS) work teachers and
 professors have received training on using email and bulletin
 boards. (1)
 Workshops. (1)
 Workshops on email and Internet. (1)
 Workshops/seminars. (1)
 In-service programs. (1)
 1-hour workshops through our school's (college's) Technology Resource
 Center. (1)
 Department - sponsored faculty workshops in using new technologies. (1)
 Demos/practice with programs that are well-constructed and meaningful
 for K-12 education. (2)
 Provide programming. (2)
 Small classes with computer - Word Perfect, Microsoft Word, SPSS, SAS.
 (2)
 Provide instruction on use of technology. (3)
 I've taken advantage of the few staff development opportunities that are
 available. (3)

Support from faculty member(s)

- Tech faculty and TAs will help at drop of a hat - we are co-presenting at conferences. (1)
- Ideas from a computer expert. (1)
- Study group - hypermedia materials. (1)
- Computer literate colleague who provides support. (1)
- Teacher Education study group. (1)
- Technology personnel are available for reference. (1)
- Faculty mentor. (1)
- Other people (faculty). (1)
- People (faculty) have helped as well as university course. (1)
- Others who are familiar with technology and willing to share. (1)
- Help from faculty colleagues. (1)
- Direct help given by faculty colleagues who are "tech experts". (1)
- Computer person on the faculty. (2)
- Ideas and information from other faculty. (2)
- Study group focused on supporting faculty in using technology. (2)
- Peer interaction. (2)
- Colleagues who share information. (3)
- Other faculty who are skilled in using. (3)

Financial support for technology hardware and software purchases

- University board - \$8000. (1)
- When I was just hired I was provided with a modest budget with which to buy a computer. (But no ongoing support to buy software. And machine is not wired into the Internet, so it mostly sits on my desk.) (1)
- College and departmental money support. (1)
- Occasional funding. (1)
- Department has purchased software. (1)
- Departmental funds for software. (1)
- Research support account for buying hardware/software. (2)
- Funds. (2)
- Carry over funds. (2)
- Availability of funds for hardware and software. (2)
- University funds for purchasing software. (2)
- Student computing accounts. (2)
- Funds available to purchase software. (3)

Hardware/software purchases through grants or outside funding

- Outside funding. (1)
- NSF - funded project. (1)
- Dreyfus grant to get 10 PCs for Microcomputer Biology Labs (MBL). (1)

\$10,000 grant to establish Internet access for NCSA and technology education programs. (1)
 Permission to buy equipment through self raised funds. (1)
 Successfully competed for a computer from Department of Education. (2)
 Securing support for purchasing software (parent groups). (3)

No support provided

None. (1)
 None. (1)
 None available. (1)
 None given. (1)

Technical support provided outside of the college

Married to professor who teaches instructional design courses. (1)
 Help from computer expert in my husband's office - not mine. (1)
 Some technical support through university and college. (2)
 Very, very minimal institutional support. (2)
 Campus support for class accounts on PC server. (2)

Workshops/seminars provided outside of college

Workshops available through the university technology center. (1)
 Center for Computing and Instructional Technology provided training and assistance. (1)

Support from undergraduate and graduate student(s)

Knowledgeable graduate student consultants. (1)
 Some students have been enormously helpful and supportive. (1)
 Help from graduate students. (2)
 Support from graduate students within school of education who are studying in the area of instructional technology use. (2)
 Ideas and information from graduate students. (3)

Support from department administration

Verbal communication from administrators. (3)
 Administration encourages use. (3)

Support from staff

Some personnel. (2)
 Some support staff help provide student instruction. (2)
 Staff specialist/mentor. (2)

Other

University newsletters. (1)

Recognition by faculty that technology is important for learning and general employment preparation. (1)

Ideas about new software/hardware. (2)

Also, trade magazines like MacWorld/MacUser. (3)

Freedom to plan to use technology and to implement these plans. (3)

Graduate courses I have taken. (3)

Conference travel. (3)

**APPENDIX K:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 5, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"What type of additional support for integrating computer-related technology would be most useful to you? Please list your suggestions below, listing the most important suggestion first."

**APPENDIX K:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 5, SECTION V**

Provide additional workshops/seminars within the college

- On going staff development/study groups. (1)
- Specific classes/workshops that target particular skills and technological applications. (1)
- Up to date training - new programs and software. (1)
- Training. (1)
- Group introduction and instruction at a time that is convenient. (1)
- Class/tutorial about what is available and how to use it. (1)
- Direct training within the unit. (1)
- Specific training which doesn't degrade the trainee in the process. (1)
- Additional training. (1)
- Faculty workshops on using Internet. (1)
- Half-day seminars on new software and upgrades. (1)
- Demonstrations of appropriate computer programs and applications. (1)
- Training. (1)
- Have to acquire knowledge of applications and plan in course activities. (1)
- Conferences or workshops that demonstrate, discuss, and provide opportunities for trying out computer-related technology. (1)
- Training for myself and other faculty.
- Skill development. (2)
- More practice sessions. (2)
- Instruction and training. (2)
- Training on use of new technologies. (2)
- Faculty workshops on using new softwares. (2)
- Hands-on assistance. (2)
- Additional training for learning new technologies. (2)
- Training programs for teachers to use communication networks. (3)
- Training on new technologies. (3)

Provide easier access to hardware and software

- VCRs in every classroom. (1)
- At current institution, technology permanently located in my classroom. (1)
- Availability of CD ROM. (1)
- Easy access to hardware/software in supported environment. (1)
- Getting an Ethernet line wired into my office. (1)
- On line capabilities in classrooms. (1)
- Availability of equipment. (1)

Provide easier access to hardware and software (cont.)

- Classrooms wired for networking. (1)
- Computer with "Bar Code" or "LCD" in every classroom with appropriate lighting/screen, etc. (1)
- In-room computer. (1)
- Better, on-site facilities. (2)
- Access to updated equipment. (2)
- Universal access to class file storage areas. (2)
- Support for distance learning to network with schools and other universities. (2)
- Enhanced availability of facilities. (3)

Provide more time

- Time. (1)
- TIME. (1)
- Time to learn. (1)
- Free time. (1)
- I could use a semester or summer to bury myself in tech/software/ It is great fun to learn how to produce, teach, explore, communicate, etc. (1)
- Blocks of time for training in new application. (1)
- Time. (1)
- Devoted time to learn and develop. (1)
- Additional time allowed for learning new technologies. (1)
- Departmental load time to do this course development. (2)
- Time. (2)
- Release time to participate in extensive training. (2)
- Time to learn to use computer-related technology, and someone to mentor that learning. (3)

Provide person to help and support individual faculty

- Roving TAs who can help in a class temporarily. (1)
- Individualized technical support to get me started and respond to immediate questions. (1)
- More individual assistance to help me learn. (1)
- More one on one instruction, small classes with computer, adequate support staff to support using technology in courses. (1)
- Training and one-on-one assistance. (1)
- Person whose job it was to assist with integrating technology into teaching. (1)
- I need a tutorial made for me. (1)
- Assistance that wouldn't make me feel inadequate! (1)
- Tutors. (2)

Knowledgeable person available for personal support and during class times. (2)

Graduate assistant. (2)

Assignment of a teaching assistant to help with integration. (3)

Provide financial support to purchase more hardware or software

Money to purchase more instructional software. (1)

Funds to purchase software. (1)

\$ for hardware/software. (1)

Budget for upgrading of equipment and software. (1)

More funding. (1)

Programs aimed at field-based experiences. (1)

New software. (2)

A budget for software. (2)

More software in the area of instructional design. (2)

Software. (3)

Budget for software/equipment. (3)

Purchase more hardware and/or upgrade hardware in place

Equipment. (1)

Upgrade equipment (have an antique MAC SE). (1)

Hardware/software. (1)

More equipment. (1)

Upgrade equipment. (1)

Microcomputer Based Labs equipment. (1)

A computer. (I still have a 640K in my office which can only run programs that are 5 years old). I don't have a printer connection either. (2)

Equipment! (3)

More memory. (3)

Instructional equipment - i.e., laptop and projector. (3)

Provide technical support within college

Technical support for instructional uses and for desktop computing. (1)

Adequate technical support for correcting software and equipment problems. (1)

Technology assistance. (1)

More help or better help. (2)

Hardware support. (2)

Technical support/assistance. (3)

Technology support staff. (3)

Hardware maintenance by people with good communication skills! (I want to know why things go wrong, in English). (3)

Support technicians to keep system running properly. (3)

I need periodic support (technical) and training. (3)
Software development support. (3)

Provide opportunities to watch others model technology use in the classroom

Modeling and tutoring assistance within the College of Educ. (1)
Demonstrations in classroom settings. (1)
Demonstrations of integrating technology into classes. (2)
Visits to sites where software is being used successfully. (2)

Organize small mentoring groups for interested faculty

Work groups. (1)
Systemic sharing among faculty. (1)
Collaborative/group staff development on innovative uses of technology.
(1)

Provide financial support for development of technology skills and integration ideas

\$ support and person to work with me and others in specific courses. (1)
Developed instructional resources. (2)
Funding support for me during summers to do development. (2)
\$ to attend workshops/seminars. (3)

Provide technology support outside college

Technology support staff/center. (1)
University-level technical and development support!!! (1)

Need for students with more expertise

My students need to know more about using the technology. (1)
Students who have had more computer experiences. (3)

Additional course time

Have course be 4 units rather than 3. (1)
Additional course time. (3)

Provide more hardware for students

My students need access to equipment and accounts that do not make it
difficult for them to use the equipment. (2)
Availability of PCs to students. (2)

Access to technology in the K-12 schools

Equipment and electronic mail more accessible in schools. (2)
School site facilities. (3)

Other

Take time from Department mission. (1)

More and better trained people in the field, rather than tech experts. (1)

The perceived need to use in my instruction. (1)

Information about who in the department is familiar with what software.
(1)

More detailed descriptions of available software. (1)

Fewer students. (1)

Follow-up support after workshops. (2)

Higher competence (mine). (3)

**APPENDIX L:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 6, SECTION V**

This appendix contains the Iowa State University faculty written responses to the following open-ended question:

"Briefly describe your most successful use of computer-related technology in teaching."

**APPENDIX L:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 6, SECTION V**

Level One Use - Discussion/Demonstration

(Professor demonstrates or discusses how technology can be used in K-12 classrooms.)

We have integrated computer-related technology and general elementary methods for 45 seniors who are in a special year-long program. One example shows that we are doing something - 37 of 45 - when asked to draw their ideal 3rd grade classroom - provided space for computers and printer. That's up from 6 of 45 the previous year. And I said nothing to lead the students to this. In fact, I was very surprised and astounded. The schools in this area are not wealthy and technology in the elementary school is very spotty. I know we do not have a measure of technology usage, but wait 'til next year.

Video disk with HyperCard showing dangerous chemical experiments.

Developing/adapting software to support student learning of business math concepts.

Making photos of every student in very large classes in order to learn names.

I've worked effectively with HyperCard stacks - video programs and MOSAIC.

Simulation software in electronics design.

Seminar - addressing issues and demands -showing students how to use home page - Yahoo.

Use Photoshop to generate images used in screen printing.

Graphic communications and writing papers.

Word processing in publishing.

Presentations of overheads using presentation software.

Use of preparing instructional materials.

Demonstration of video disk integrated teaching package.

Preparation of overheads.

Individual/group advisement, discussion of course content.

Videotapes.

Use of Powerpoint for lecture discussion of course material.

Use the computer as an electronic slideshow with software such as Powerpoint and Harvard Graphics. This adds color, clip art, and sound to lectures.

Using interactive computer simulations for teaching about population ecology and photosynthesis in an intro biology class for elementary education majors. These two topics have been consistently difficult to understand, and the simulations made a big difference in the students' grasp of the topics.

Level Two Use - Technology Practice

(Preservice teachers learn how to use technology through hands-on experiences and practice)

E-mail discussions/community building.

Internet-based course to help students learn about using Internet resources for/in instruction.

I use to spend a class in which my methods students tried out and then critically analyze sample instructional software. The generally responded quite favorably - thought it quite useful.

Email communication with students. Minimum use required but a growing number go far beyond with excellent results. I can provide level of support to students not feasible otherwise.

I haven't used it in teaching but electronic communication in greatly helps in contacting students.

Hypermedia in introductory course where students did "child study."

Listserves.

This occurred in teaching mathematics, not education. I designed some activities in calculus that offered students the opportunity to learn) examine a large number of specific cases in order to make inferences and generalizations
 ii) when it might be silly to use "high-tech" computer technologies.

Use in Institute (summer) on integration. Facilitated teaching and project work.

Analyzing motor performance.

"Applications of Technology to the Science Classroom" - a course designed to help students learn uses of various technologies for their classrooms; word processing, spreadsheet, grading programs, HyperCard, CD ROM, interactive video, etc.

Robotics.

Use of CD ROM discs containing lesson plans.

All my students use computers for word processing and some of them for e-mail.

Using probeware in microcomputer-based labs enabled conceptual understanding without undue dependence on tedious mathematics computation.

Using Internet news groups to share ideas with other educators.

I use an outstanding software package that teaches exactly what/how I would teach the same topic without a computer. The software is a simulations package that allows students to perform multiple tests of a natural phenomena (crossing two organisms for genetic traits) that would/use to take weeks to do.

I teach seniors how to develop and use Powerpoint presentations, - most love it and do an excellent job.

Introduction to Internet - - students are asked to explore their area of expertise or interest.

Email to communicate with students regularly.

Interactive video disk for video based case teaching.

Fast plant research and learning styles action research with undergraduate students. They were trained to understand techniques of assuring fast plant cycles (seed to seed). Research was identified and students pursued it and reported, analyzed, etc. on computer (Did searches for data on Internet too.)

We use a program of interactive computer/laser integrated language learning (e.g., Spanish as a foreign language) and culture.

Evaluation of software (ordered on preview status and returned).

Interactive video cases of elementary science teaching for use in developing reflection in elementary science methods courses.

Use of CD-ROM equipped computers having assistive technology installed that are linked to Tarco Projection systems permitting easily seen demo's of technology applications to be viewed and discussed, and manipulated interactively by students. This is followed up by actual lab-based activities in which students carry out hands on applications.

Use in Chemistry for simulations and drill and practice.

Use in methods course (simulations and drill and practice) for lab activities.

Teaching e-mail to 180 students and requiring three e-mail assignments handed in.

As a research reference tool for me and students.

Computer-generated individualized homework software developed at my university.

Email to students

Word process makes papers easier to write.

I used it to interact with students in a course that met only 1/week. This allowed us to continue discussions between class meeting.

Level Three Use - Professional Practice

(Preservice teachers observe K-12 teachers using technology and/or practice teaching with technology)

Getting some of my students to use email (and telnet and Gopher) to tap into resources beyond the boundaries of our campus.

Use of problem solving software with elementary and college students. e.g., Oregon Trail, Sir Isaac Newton's Games, What do You do with a Broken Calculator, etc.

Simulation programs which are integrated into the curriculum.

Focus on word processing for kids in Grade K-6; really supports writing process.

Computer-based lab on cooling curve, using a temperature probe. With university seniors in methods course. Addressed need if calibration of instrument (which science majors did not comprehend) as well as data acquisition, analyses, and interpretation. In addition, a discussion of how this lab could be used in high school science classes.

The development by preservice students of video cases that involved videotaping in classrooms, audio taping an interview about the class and superimposing the audio tape over the video - - then showing the tape to their peers.

It mostly occurs when I take students out in the field. Schools seem to have more up to date equipment and materials and students can interact with both technology and with children.

Directing student development of individual or group projects using a variety of technologies.

Along with a foundations course in education, I teacher several "Computer and Design" courses for technology education and engineering students. Each semester I get calls from former student who are using "CAD" software as part of their teaching or engineering work. Almost all of them say their experiences with our software gave them a good foundation for future computer use.

Actually since we are technology education I have students teach a reflective lesson using a computer/software process as lesson content.

Use of LAN-based terminals for real-time data collection in 9th grade physical science, including word processing for student lab reports and use of video-cam to project demo's.

All students have Internet accounts and regularly use e-mail, worldwide web, ftp, and telnet protocols in order to utilize information and materials for class projects.

Use of Function Probe and Geometer's Sketchpad in secondary math method's course. I demonstrated a few things, had the students go through a tutorial that focused on solving problems, not just the details of the software, and then many of them "took off" designing their own problems that secondary math students could use the software to investigate.

**APPENDIX M:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 7, SECTION V**

This appendix contains any additional written comments, suggestions, or concerns made by peer university respondents.

**APPENDIX M:
PEER UNIVERSITY FACULTY WRITTEN RESPONSES
TO SURVEY ITEM 7, SECTION V**

I am not opposed to the use of computer-related technology as a teacher. However, in my teaching I strongly believe in the importance of interaction between teacher and student for learning - both the teacher and student. At the moment, technology does not seem to be critical or necessary to my teaching.

Unless Schools of Education acquire the hardware and software needed, the preparation of pre and inservice teacher will continue to be antiquated.

The issue for me is TIME. If I'm going to learn and use the technologies I'm going to have to make it a priority. Our department and school provides good support - I have a great computer in my office and other technologies are readily available.

Very discouraging to use computer technology when the university does not have the funds to purchase much needed equipment.

I teach courses on use of assistive technology (e.g., adaptive solutions to computer access): it has become imperative for me to be able to, not only know special software & devices, but be able to teach their use, i.e., develop actual skills: thus, I must integrate technology as a given. I have no excuses for not doing so!

You don't consider using computer as data collection instruments in science labs (MBL).

My biggest constraints were:
time
number of students - too high
quality of help
my own expertise

I am one of the technology faculty and support staff for the school. Therefore, my answers are sure to be atypical. Most faculty are hesitant to use technology and need much greater levels of comfort and support. Regrettably, in our School, funding for faculty technology support is almost non-existent.

The schools in this area are not wealthy and tech in the elementary school is very spotty.

The TEACHER is most important for learning success. The computer is just the SLATE & CHALK OF TODAY & SHOULD NOT be emphasized beyond its worth. Deans are duped into believing a room full of computers evidences a good learning environment.

Computers have increased our work load!!!

At my current institution, the bureaucracy makes it difficult to even plan to use technology because of competing class times and demands for equipment and needing to move equipment substantial distances (or relocating entire classes of students to different rooms). This is far more suited to traditional college instruction than for the teacher education strategies I utilize (which are constructivist).

I know we do not have a measure of tech usage, but wait 'til next year.

I teach courses in children's literature and do not have computers with CD ROM that would enable me to use books that are available in CD ROM format. Besides, they are too expensive.

I recently wrote a research grant which provided me with a Power Mac. Without the grant, my computer (Mac SE) had so little memory that I did not dare to ask my under grads to use e-mail. There is a lot of talk re: technology, but equipment is not available for everyone. This limits who can and cannot participate.

At my previous institution I was able to utilize technology permanently located in my classroom. It included a computer, laserdisk player, TV and VCR. This allowed not only planned lessons utilizing technology, but also spontaneous use. At my current institution, the bureaucracy makes it difficult to even plan to use technology because of competing class times and demands, for equipment and needing to move equipment substantial distances (or relocating entire classes of students to different rooms). This is far more suited to traditional college instruction than for the teacher education strategies I utilize (which are constructivist).

This fall 2 other math/science ed professors and myself are going to organize a conference for 2 class sections from previous spring semester during student teaching. We hope to provide support for teaching math and science in gr. K-8. Also to have students explore issues and share experiences among themselves during this important part of their teacher ed program.

Overload of roles in teaching, research and service is my biggest obstacle to doing more.

Difficulty in staying current in such fast-changing technologies.

Equipment, training and support are needed if this revolution is to occur.

Labs are a waste of money and space - each professor or 2-3 professors share a mobile unit for class use.

As mentioned earlier, throwing together all computer-related technology is meaningless. Increasing the proliferation of email is actually preventing me from doing any real work. Most trips through the Internet are time consuming but like watching junk TV. In policy analysis classes its valuable to have students have access to quantitative means of analysis. But, it remains that the main problem is making sense of data, not just acquiring it. There is lots out there, most of it's anonymously publish and it all detracts from reading and talking to actual people.

Can't see how I would or could use it.

The world of technology is moving along fast without me.

I haven't used any yet, but I'm planning to use it next year.

Haven't used it yet - plan to begin fall '95.

Although computer/technology hardware and software is often minimal in the elementary classrooms where many of our pre-service elementary teachers get their field experience, it is often non-existent in the university classrooms where we try to offer "methods" courses, etc. If hardware/etc. does exist for use in such college courses, it is because it was purchased (often) by a tenured professor's research grant, not by the University or the Teacher Education Department. Thus, sections of courses taught by new faculty, instructors, or graduate students don't have equivalent access to such resources, and so the learning experiences available to their students suffer from this lack of equitable distribution of resources.

Not sure of the benefits of computer instruction.

Computers are seen as a substitute for thinking clearly about what concepts need to be learned. Have not seen computer software or innovations that go beyond fun and games.

Our teacher Ed students (both preservice and inservice) are now required to take a core course in technology (as of 1995-96). I hope this will help.

I am astounded and appalled at the lack of computer and other technological equipment in many of our schools. While the suburbs seem to fare well, the urban schools lack facilities - especially for teachers who work with language minority student (ESL teachers). The inequity is frightening. It is difficult to encourage interest in teachers when they have very limited access to equipment.

Our faculty development endeavor should include more opportunities to learn more computer-related technologies - I'm embarrassed with my responses in Section II.

Lack of funding is a major concern.

**APPENDIX N:
DOCUMENTATION OF HUMAN SUBJECTS APPROVAL**

This appendix contains the Human Subjects Form showing approval granted by the Iowa State University Human Subjects Review committee.

Information for Review of Research Involving Human Subjects

Iowa State University

(Please type and use the attached instructions for completing this form)

1. Title of Project A Survey of the Use and Integration of Computer-Related Technology
Use by Teacher Education Faculty
2. I agree to provide the proper surveillance of this project to insure that the rights and welfare of the human subjects are protected. I will report any adverse reactions to the committee. Additions to or changes in research procedures after the project has been approved will be submitted to the committee for review. I agree to request renewal of approval for any project continuing more than one year.

Denise Schmidt 4/10/95 _____
Typed Name of Principal Investigator Date Signature of Principal Investigator

Curriculum and Instruction N165A Iagomarcino 794-0741
Department Campus Address Campus Telephone

3. Signatures of other investigators Date Relationship to Principal Investigator
Alan D. Thomas 4-11-95 *Mary Parker*

4. Principal Investigator(s) (check all that apply)
☒ Faculty ☐ Staff ☒ Graduate Student ☐ Undergraduate Student
5. Project (check all that apply)
☐ Research ☒ Thesis or dissertation ☐ Class project ☐ Independent Study (490, 590, Honors project)

6. Number of subjects (complete all that apply)
450 # Adults, non-students _____ # ISU student _____ # minors under 14 _____ other (explain)
_____ # minors 14 - 17

7. Brief description of proposed research involving human subjects: (See instructions, Item 7. Use an additional page if needed.)

please see attached.



(Please do not send research, thesis, or dissertation proposals.)

8. Informed Consent: ☐ Signed informed consent will be obtained. (Attach a copy of your form.)
☒ Modified informed consent will be obtained. (See instructions, item 8.)
☐ Not applicable to this project.